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Uncertain product risk, information acquisition, and product liability

Tim Friehe [*,a,b,c], Elisabeth Schulte [a]

[a] Marburg Centre for Institutional Economics (MACIE), Philipps-University of Marburg, Germany
[b] CESifo, Munich, Germany
[c] EconomiX, Paris, France

HIGHLIGHTS

- We study incentives to acquire information about the risk of newly developed products.
- Firm's incentives are influenced by product liability and regulatory product approval.
- Firm's incentives may be insufficient or excessive.
- Our analysis identifies efficiency-inducing liability rules.

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ABSTRACT

We describe how product liability interacts with regulatory product approval in influencing a firm's incentives to acquire information about product risk, using a very parsimonious model. The firm may have insufficient information acquisition incentives if it is not fully liable for the harm caused by its product. The firm may also have excessive information acquisition incentives under both full and limited liability. Our analysis identifies efficiency-inducing liability rules.

1. Introduction

Firms face uncertainty regarding the harmful nature of newly developed products. Pre-market experimentation in controlled environments allows information acquisition about a new product's riskiness. This note studies a firm's incentives to acquire such information in a framework in which the firm is subject to both strict product liability and a regulatory product-approval procedure. We show that the firm's information acquisition incentives may be insufficient or excessive. We describe how this depends on the liability rule, and we identify the liability design that facilitates the attainment of the first-best outcome.

The fact that liability rules can influence the incentives regarding the acquisition and sharing of information about risk has been emphasized by Arlen (2016) and Shavell (1992), among others. Wagner (2004, 2016) argue that the law often produces perverse incentives; that is, it deters agents from generating more information about risk due to misaligned interests. This misalignment is central to our paper.

Our inquiry is related to Shavell (1992). In that paper, parties can buy information about the riskiness of their actions, and the value of such information stems from the ability to lower social costs by tailoring the level of care to the circumstances at hand. The author concludes that strict liability with full compensation ensures efficiency; however, in our setup, strict liability with partial compensation may be required for efficiency. In Baumann and Friehe (2016), information about the accident technology is obtained via learning-by-doing, and distorted negligence standards can be optimal. Similarly, Goeschl and Pfrommer (2015) explore learning-by-doing by studying a framework in which additional information can only be obtained when a sufficient number of firms actually market the product innovation, finding that negligence rules may be superior in such a context. In contrast, our study focuses on experimentation that occurs before the marketing of

* Corresponding author.
E-mail addresses: tim.friehe@wiwi.uni-marburg.de (T. Friehe), elisabeth.schulte@wiwi.uni-marburg.de (E. Schulte).

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the product. In addition, there is an extensive literature on how liability rules and other policy instruments can influence the incentives to innovate (e.g., Endres and Bertram, 2006; Immordino et al., 2011), whereas our paper focuses on the acquisition of information about risk for a product that the firm has already developed.

Our paper is also related to the literature on information provision by interested parties, in particular Bennedsen and Feldmann (2006), Dahm and Porteiro (2008), and Kamenica and Gentzkow (2011). Bennedsen and Feldmann (2006) study how the interaction between two instruments can influence a decision, information provision, and monetary payments. They demonstrate that the provision of information may increase the expected cost of bribing the decision-maker. Dahm and Porteiro (2008) examine an interest group's preferences for information provision in a more general setting and identify factors that induce voluntary information provision by the interest group. Kamenica and Gentzkow (2011) investigate the kind of information that an interested party ideally acquires in order to persuade a decision-maker. Our analysis also features an interested party with access to information. Preferences for information acquisition and provision are influenced by liability, since the liability rule determines both the extent to which the interested party's preferences are state-dependent and the extent to which these preferences are misaligned with the decision-maker's preferences.

2. The model

Suppose that a firm has invented a product that, if marketed, will generate a rent π for the firm and a consumer surplus CS. The product may also cause harm h to society. The true harm probability is either zero or one, defining the state of the world. Due to the novelty of the product, the actual level of the harm probability is unknown, such that a commonly held prior $p_0 \in (0, 1)$ initially applies. Conducting an experiment will reveal the true harm probability with a known and possibly state-dependent probability less than one, and will yield an inconclusive outcome otherwise. The act of conducting the experiment and its outcome are publicly observable. If the experiment is conducted, the posterior p_1 is equal to either zero or one if the experiment is successful, and equal to $p_n \in (0, 1)$ if the experiment yields an inconclusive result. If no experiment is conducted, $p_1 = p_0$ holds. The firm decides whether or not to conduct the experiment.

Marketing the product is possible only with the approval of the regulator. The regulator is tasked with deciding whether or not to approve the product, taking into account the information available about the product's riskiness. The regulator seeks to maximize the sum of the firm's rent and consumer surplus, net of the expected harm to society.

The firm seeks to maximize its rent, net of expected liability payments. The firm is liable for a fraction α of any harm caused by its product, $0 \leq \alpha \leq 1$. As in Chen and Hua (2012), among others, we consider the possibility of partial liability. We consider full liability as the baseline.

The course of events is as follows: First, the product risk is drawn. The firm then decides whether or not to (publicly) conduct the experiment. Subsequently, the firm decides whether or not to file the product for approval. Finally, the regulator decides on product approval, and the corresponding payoffs result.

3. The analysis

Both players have a veto right over the marketing of the product. The regulator approves the product if and only if $\pi + CS - p_1 h \geq 0$, i.e., $p_1 \leq \bar{p}_r = (\pi + CS)/h$. The firm markets the product if and only if $\pi - p_1 \alpha h \geq 0$, i.e., $p_1 \leq \bar{p}_f = \pi/(\alpha h)$. If p_1 exceeds at least one of these thresholds, the product is not marketed, and both players' payoffs are zero.

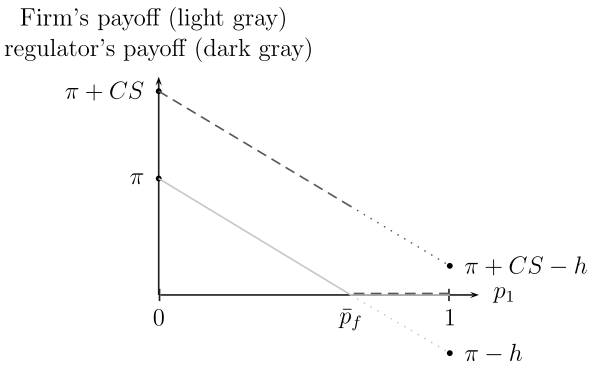

Fig. 1. Full liability, $\pi < h < \pi + CS$.

The thresholds of the firm and the regulator, $\bar{p}_f$ and $\bar{p}_r$, may differ, as the firm ignores consumer surplus and the share $1 - \alpha$ of the harm. The thresholds are equal if $\alpha = \pi/(\pi + CS)$. For smaller values of α, the firm is more eager than the regulator to market the product, and *vice versa*. If $\min\{\bar{p}_f, \bar{p}_r\} \geq 1$, both the firm and the regulator always want to market the product, implying that there is neither a benefit from information acquisition nor a role for a regulator in such a parameter constellation. Because this is true for the firm for any liability rule α if $\pi \geq h$, we assume $\pi < h$ and differentiate Scenario H in which $\pi + CS \geq h$ (i.e., $\bar{p}_r \geq 1$) from Scenario L in which $\pi + CS < h$ (i.e., $\bar{p}_r < 1$).

3.1. Full liability

If $\alpha = 1$, $\bar{p}_f < \bar{p}_r$, since $CS > 0$. If the firm decides to market the product, the regulator will approve it.

3.1.1. Scenario H

We now assume that $h < \pi + CS$. Fig. 1 depicts the players' expected payoffs as a function of p_1.

The firm's payoff is a convex, piecewise linear function with a kink at $\bar{p}_f$. The convexity of payoffs – due to the outcomes in which the firm can ensure a payoff of zero instead of a negative payoff – implies that the firm is better off conducting the experiment for any $p_0 \in (0, 1)$; that is, the firm is information-loving.[1]

The regulator's payoff exhibits a discrete jump from a strictly positive value to zero at $p_1 = \bar{p}_f$. If $p_0 > \bar{p}_f$, the regulator benefits from the firm's information acquisition because the firm will not market the product without further information, but may do so after having conducted an experiment. If $p_0 < \bar{p}_f$, the regulator's preference is for the firm to market the product without collecting additional information, as conducting the experiment implies the risk that the firm may not market the product.

Lemma 1. *Suppose full liability (i.e., $\alpha = 1$) and $\pi < h < \pi + CS$.*

If $p_0 \leq \bar{p}_f$, the firm has excessive information acquisition incentives. Otherwise, the firm's information acquisition incentives are efficient.

In order to deter excessive information acquisition, the firm's payoff must not be convex in p_1. This is achieved by limiting the liability payment to π, or by setting α equal to π/h.

Proposition 1. *If $\pi < h < \pi + CS$ and $p_0 \leq \bar{p}_f$, efficient information acquisition can be induced by a strict liability rule with partial compensation fixed at $\alpha = \pi/h$.*

[1] The firm's payoff is strictly convex if α exceeds π/h, which is less than one by assumption.