Online Appendix for "Optimal Liability when Consumers Mispredict Product Usage"

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Appendix B

In this appendix, we first characterize the negligence regime when the due standard of safety deviates from x^{FB}, so that $x^{NG}=x^{FB}+\varepsilon$, perhaps due to court error (ε).We let $x^{NG}\leq x^*(\hat{a})$, where $x^*(\hat{a})>x^{FB}$ is the optimal level of safety for the ex-post level of activity associated with the use of a perfectly safe product or, equivalently, the equilibrium level of safety under strict liability (see Section 3.2). We then draw on and extend that analysis in an attempt to characterize the socially optimal safety standard when the exact distribution of α is known to the authorities (i.e. the courts) choosing the standard

We first examine firms' incentives to satisfy or violate a given due standard of safety $x^{NG}\leq x^*(\hat{a})$. Define $\alpha^{NG}(x^{NG})$ as the value of α such that $x^{NL}(\alpha)=x(\alpha)=x^{NG}$. Note that since $x^{NL}(\alpha)$ is increasing in α (see Appendix A), $\alpha^{NG}(x^{NG})$ is increasing in x^{NG}. Furthermore, since $x^{NL}(1)=x^{FB}$, it follows that $\alpha^{NG}(x^{NG})<1$ if $x^{NG}<x^{FB}$, $\alpha^{NG}(x^{FB})=1$, and $\alpha^{NG}(x^{NG})>1$ if $x^{NG}\in(x^{FB},x^*(\hat{a}))$. The firms serving consumers of type $\alpha\geq\alpha^{NG}(x^{NG})$ therefore always optimally choose to satisfy the due standard of safety x^{NG} and operate under a de facto no liability regime. It then follows that whenever $\alpha\geq\alpha^{NG}(x^{NG})$, the consumers under the negligence rule choose the ex-ante level of activity equal to the ex-ante level of activity chosen under the no liability rule: $a_1^{NG}(\alpha)=a_1^{NL}(\alpha)\geq a^{FB}$.

Consider, next, a firm that serves consumers for whom $\alpha<\alpha^{NG}(x^{NG})$. Suppose that such a firm violates the negligence standard and chooses $x'<x^{NG}$. Then, the firm is subject to strict liability rule, in which case (see Section 3.2) the firm would optimally choose $x^{SL}=x^*(\hat{a})\geq x^{NG}$. This contradicts the original supposition that the firm violates the negligence standard. Furthermore, the firm that offers a product with safety level $x<x^{NG}$ charges the price equal to $C(x)+\hat{a}H(x)$. Then, by analogous reasoning as in Section 3.3, competitors will offer a product with a higher safety level and at a lower prices. Hence, $x<x^{NG}$ is not an equilibrium. Under the negligence rule with x^{NG}, the firms serving consumers with $\alpha<\alpha^{NG}(x^{NG})$ therefore satisfy the negligence standard by choosing $x^{NG}(\alpha)=x^{NG}$ and setting price equal to $C(x^{NG})$ for all $\alpha<\alpha^{NG}(x^{NG})$. Accordingly, when $\alpha<\alpha^{NG}(x^{NG})$, the consumer's ex-ante activity level equals

$a_1^{NG}(\alpha)$=argmax$_a\{B(a,\alpha)-C(x^{NG})-aH(x^{NG})\}$, which is increasing in α. The consumer's anticipated net utility for a given x^{NG} equals

$$U_1^{NG}(\alpha,x^{NG})=\begin{cases} B(a_1^{NG}(\alpha),\alpha)-C(x^{NG})-a_1^{NG}(\alpha)H(x^{NG}) & \text{if } \alpha<\alpha^{NG}(x^{NG}) \\ U_1^{NL}(\alpha) & \text{if } \alpha\geq\alpha^{NG}(x^{NG}), \end{cases} \qquad \text{(B1)}$$

where $U_1^{NL}(\alpha)$ is defined in (9). The following result (proof is analogous to the proof of Lemma 4 and thus omitted) summarizes the properties of the function $U_1^{NG}(\alpha, x^{NG})$.

Lemma B1: *$U_1^{NG}(\alpha,x^{NG})$ is increasing in α for all $\alpha>0$. $U_1^{NG}(\alpha,x^{NG})<U_1^{NL}(\alpha)$ for $\alpha<\alpha^{NG}(x^{NG})$. Furthermore, there exists $\alpha_0^{NG}(x^{NG})>0$ such that $U_1^{NG}(\alpha,x^{NG})<0$ for all $\alpha<\alpha_0^{NG}(x^{NG})$, $U_1^{NG}(\alpha_0^{NG}(x^{NG}),x^{NG})=0$, and $U_1^{NG}(\alpha,x^{NG})>0$ for all $\alpha>\alpha_0^{NG}(x^{NG})$, where $\alpha_0^{NG}(x^{NG})$ is increasing in x^{NG}, $\alpha_0^{NG}(x^{NG})<\alpha^{NG}(x^{NG})$, and $\alpha_0^{NG}(x^{NG})<\alpha_0^{SL}$ for $x^{NG}\leq x^{FB}$.*

That is, under negligence rule, consumers with the lowest values of α abstain from purchasing the product; all other consumers purchase the product. Note that if the due standard is particularly restrictive so that $x^{NG}>x^{FB}$, then it may happen that $\alpha_0^{NG}(x^{NG})>1$ and therefore even some consumers who ex ante overestimate the benefits of the product will choose not to purchase the product. Furthermore, the comparison of the threshold value of α such that the consumers under the negligence rule with standard x^{NG} purchase the product with the corresponding threshold value under the strict liability rule is in general ambiguous and depends on x^{NG}. When $x^{NG}\leq x^{FB}$, consumers who under strict liability would have not purchased the product purchase the product under the negligence regime ($\alpha_0^{NG}(x^{NG})<\alpha_0^{SL}$). When $x^{NG}\in(x^{FB}, x^*(\hat{a})]$, however, the relationship between $\alpha_0^{NG}(x^{NG})$ and α_0^{SL} is ambiguous.

In period 2, all consumers for whom $\alpha\geq\alpha^{NG}(x^{NG})$ ex post choose $a_2^{NG}(\alpha)=a_2^{NL}(\alpha)$ and enjoy experienced net utility equal to experienced net utility under no liability, $U_2^{NL}(\alpha)$. The consumers with values of α smaller than $\alpha^{NG}(x^{NG})$ who nevertheless purchase the product at given due standard of safety x^{NG} (i.e. those with $\alpha\in[\alpha_0^{NG}(x^{NG}),\alpha^{NG}(x^{NG})))$ choose the ex-post activity level a_2^{NG}=argmax$_a\{B(a)-C(x^{NG})-aH(x^{NG})\}$. Thus, $a_2^{NG}=a^*(x^{NG})$. Consequently, experienced net utility for consumer of type $\alpha\in[\alpha_0^{NG}(x^{NG}),\alpha^{NG}(x^{NG}))$ under the negligence rule with due standard of safety $x^{NG}\leq x^*(\hat{a})$ equals

$$U_2^{NG}(x^{NG})=B(a^*(x^{NG}))-C(x^{NG})-a^*(x^{NG})H(x^{NG}). \qquad \text{(B2)}$$

The following result (proof omitted) characterizes the properties of (B2):

Lemma B2: *Experienced net utility in* (B2), *which is independent of* α, *is increasing for* $x^{NG}<x^{FB}$, *decreasing for* $x^{NG}>x^{FB}$, *and attains maximum at* $x^{NG}=x^{FB}$.

Since $x^{NG}=x(\alpha^{NG})$ by definition of $\alpha^{NG}(x^{NG})$ (see above), (B2) can be expressed as

$$U_2^{NG}(x^{NG})=B(a^*(x(\alpha^{NG}))-C(x(\alpha^{NG}))-a^*(x(\alpha^{NG}))H(x(\alpha^{NG}))=U_2^{NL}(\alpha^{NG}(x^{NG})). \quad \text{(B3)}$$

Therefore, experienced net utility of consumer of type α who purchases the product, and hence the social welfare from the product offered to consumer of type α, under the negligence standard $x^{NG}\leq x^*(\hat{a})$ equals

$$U_2^{NG}(\alpha,x^{NG})=\begin{cases}0 & \text{if } \alpha<\alpha_0^{NG}(x^{NG})\\ U_2^{NL}(\alpha^{NG}(x^{NG})) & \text{if } \alpha\in[\alpha_0^{NG}(x^{NG}),\alpha^{NG}(x^{NG}))\\ U_2^{NL}(\alpha) & \text{if } \alpha\geq\alpha^{NG}(x^{NG}).\end{cases} \quad \text{(B4)}$$

where $U_2^{NL}(\alpha)$ is defined in (10). A family of functions $U_2^{NG}(\alpha,x^{NG})$, one for each value of x^{NG}, is shown in Figure B1. That is, for a given x^{NG}, each of these functions begins at the constant value equal to $U_2^{NL}(\alpha^{NG}(x^{NG}))$ for values of α greater or equal to $\alpha_0^{NG}(x^{NG})$ and smaller than $\alpha^{NG}(x^{NG})$ and then coincides with $U_2^{NL}(\alpha)$ for values of α greater than $\alpha^{NG}(x^{NG})$. Social welfare under the negligence rule for a given standard x^{NG} and distribution $F(\alpha)$ then equals

$$\Omega^{NG}(x^{NG})=U_2^{NL}(\alpha^{NG}(x^{NG}))\left[F(\alpha^{NG}(x^{NG}))-F(\alpha_0^{NG}(x^{NG}))\right]+\int_{\alpha^{NG}(x^{NG})}^{\infty}U_2^{NL}(\alpha)f(\alpha)d\alpha \quad \text{(B5)}$$

Upon comparing Figure B1 with Figure 3 it follows that none of the qualitative conclusions summarized in Section 4 change as long as the due standard of safety does not significantly deviate from x^{FB}.

Drawing on the analysis above, we next examine the characteristics of a socially optimal safety standard when the exact distribution of α is known to the authorities (i.e. the courts) choosing the standard. That is, we ask: For a given known distribution of α, what level of x^{NG} maximizes social welfare (B5)? Differentiating (B5) with respect to x^{NG} using Leibniz's rule and simplifying gives

$$\frac{d\Omega^{NG}(x^{NG})}{dx^{NG}}=-\frac{d\alpha_0^{NG}(x^{NG})}{dx^{NG}}U_2^{NL}(\alpha^{NG}(x^{NG}))f(\alpha_0^{NG}(x^{NG}))+\frac{dU_2^{NG}(x^{NG})}{dx^{NG}}\left[F(\alpha^{NG}(x^{NG}))-F(\alpha_0^{NG}(x^{NG}))\right]. \quad \text{(B6)}$$

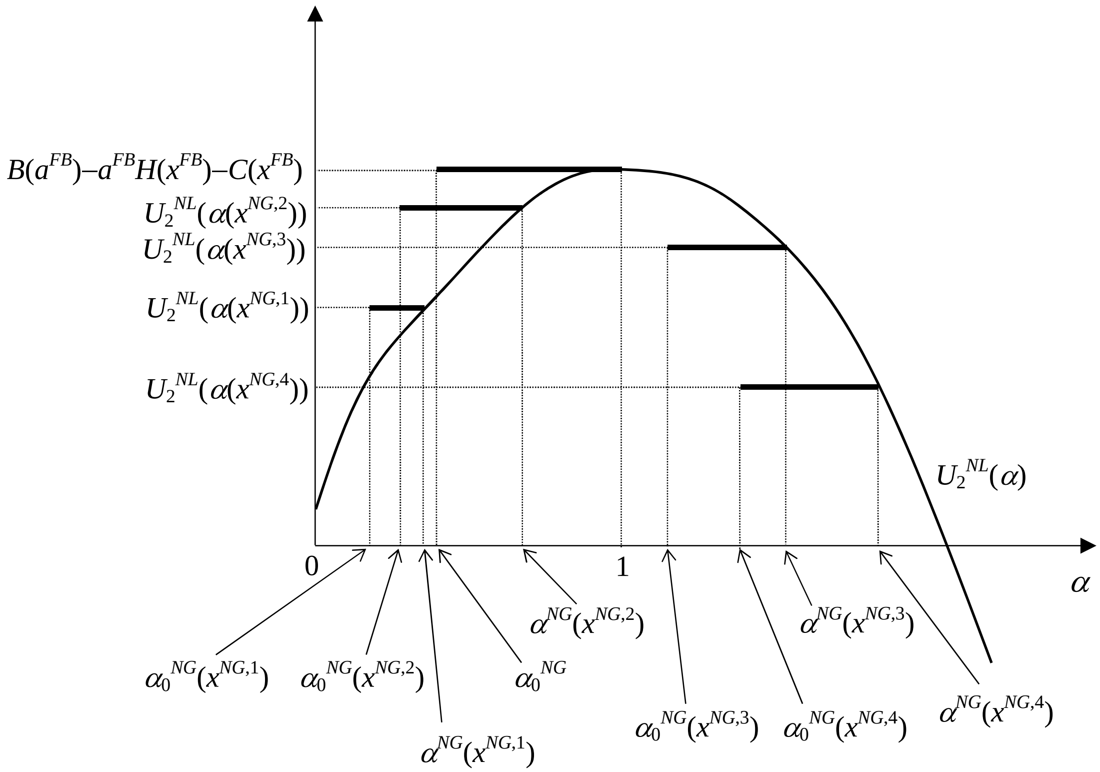
The first term on the right-hand side of (B6) is the reduction in social welfare that arises because fewer consumers choose to purchase the product under a stricter safety standard. When $f(\alpha)>0$ for all $\alpha>0$, this term is always negative since by Lemma B1, $\alpha_0^{NG}(x^{NG})$ is increasing in x^{NG}. The second term is the change in social welfare due to the fact that a stricter safety standard also impacts the experienced net utility of consumers who purchase the good (see Figure B1). By Lemma B2, the sign of the second term on the right-hand side of (B6) depends on the level of safety standard x^{NG}. In particular, for $x^{NG} \geq x^{FB}$, the effect of a marginally stricter safety standard on experienced net utility of consumers who purchase the good is non-positive. Thus, when $f(\alpha)>0$ for all $\alpha>0$, the expression (B6) is strictly negative for $x^{NG} \geq x^{FB}$ which in turn implies that the socially optimal negligence standard x^{NG} when the distribution of α is known should be set lower than x^{FB}. The function $\Omega^{NG}(x^{NG})$ is continuous on the interval $[0,x^{FB}]$. By Weierstrass' Theorem, $\Omega^{NG}(x^{NG})$ thus attains a maximum on the interval $[0,x^{FB}]$. Where exactly the maximum occurs, however, is in general unclear since it is without additional assumptions not possible to ascertain whether $\Omega^{NG}(x^{NG})$ is monotonic or non-monotonic on the interval $[0,x^{FB}]$.

To further illustrate the ideas about the optimal negligence standard when the exact distribution of α is known to the authorities choosing the standard, we examine two special cases of the distribution of consumers with respect to their misprediction: (i) $f(\alpha)>0$ only for $\alpha \geq 1$ and (ii) $f(\alpha)>0$ only for $\alpha \leq 1$. That is, under case (i) no consumer underestimates and under case (ii) no consumer overestimates the ex-post benefits from, and the extent of, product usage.

Consider case (i): $f(\alpha)>0$ only for $\alpha \geq 1$. Note that in this case, it is enough to consider only negligence standards $x^{NG} \geq x^{FB}$ since with $f(\alpha)=0$ for $\alpha<1$ and thus any $x^{NG}<x^{FB}$ gives rise to exactly the same social welfare as does $x^{NG}=x^{FB}$ (see Figure B1). Assume, first, that the negligence standard is particularly restrictive (x^{NG} notably exceeds x^{FB}) so that $\alpha_0^{NG}(x^{NG}) \geq 1$, where $\alpha_0^{NG}(x^{NG})$ is defined in Lemma B1 (see also Figure B1). Under this standard, not all consumers purchase the product: the consumers with $\alpha \in [1,\alpha_0^{NG}(x^{NG}))$ abstain from purchasing the product. Social welfare under the negligence rule for a given standard x^{NG} and distribution $F(\alpha)$ is then given by (B5) and the change in social welfare because of a marginal increase in x^{NG} is given by (B6). The first term on the right-hand side of (B6) is negative since $\alpha_0^{NG}(x^{NG})$ is increasing. The second term on the right-hand side of (B6) is negative by Lemma B2. Hence, social welfare is decreasing in x^{NG}. Assume, next, that the negligence standard is not so restrictive (x^{NG} either slightly exceeds x^{FB} or equals x^{FB}) so that $\alpha_0^{NG}(x^{NG})<1$. Under this standard, since $\alpha \geq 1$ for all consumers, all consumers purchase the product and marginal increase in the negligence standard has no effect on the number of consumers who purchase the product. Thus, the first term on the right-hand side of (B6) is zero. By Lemma B2, the second term on the right-hand side of (B6) is negative when $x^{NG}>x^{FB}$ and zero when $x^{NG}=x^{FB}$. It follows that when $f(\alpha)>0$ only for $\alpha\geq1$, social welfare attains maximum at $x^{NG}=x^{FB}$ and is decreasing for $x^{NG}>x^{FB}$. Thus, the socially optimal negligence standard in this case equals $x^{NG}=x^{FB}$.

Consider now case (ii): $f(\alpha)>0$ only for $\alpha\leq1$. Note that when $x^{NG}\geq x^{FB}$ and the negligence standard is not too restrictive, the first term on the right-hand side of (B6) is negative (see Figure B1). (When x^{NG} notably exceeds x^{FB}, the social welfare effect of a marginal increase in the strictness of the standard is zero since $f(\alpha)=0$ for all $\alpha>1$.) By Lemma B2, the second term on the right-hand side of (B6) is zero when $x^{NG}=x^{FB}$ and negative when $x^{NG}>x^{FB}$. Therefore, the socially optimal negligence standard must satisfy $x^{NG}<x^{FB}$. With $f(\alpha)>0$ for $\alpha\leq1$ and $x^{NG}<x^{FB}$, however, the first term on the right-hand side of (B6) is negative whereas the second term on the right-hand side of (B6) is positive by Lemma B2. It is in general difficult to say which term dominates and, thus, unambiguously identifying the optimal negligence standard for the case when $f(\alpha)>0$ only for $\alpha\leq1$ is not possible without additional assumptions.

Figure B1: Experienced net consumer utility under negligence for $x^{NG} \neq x^{FB}$



Notes: $U_2^{NL}(1)=U_2^{NL}(\alpha(x^{FB}))=B(a^{FB})-a^{FB}H(x^{FB})-C(x^{FB})$, $\alpha_0^{NG}\equiv\alpha_0^{NG}(x^{FB})$, $\alpha^{NG}(x^{FB})=1$. The figure assumes $x^{NG,1}<x^{NG,2}<x^{FB}<x^{NG,3}<x^{NG,4}$.

Appendix C

In this appendix, we contrast the three legal regimes when consumers do not possess perfect information about product risks per unit of activity (as captured by $H(x)$) and instead know only average product risk per unit of activity (see, e.g., Shavell 1987, 2007).

Consider first no liability. If consumers know only average product risk, then "firms will clearly select x=0, for choosing a positive x would be costly to a firm, yet not increase the price at which it could sell the product" (Shavell 1987: 67). Thus, in equilibrium, all firms sell product with safety level $x^{NL}=0$, which in turn equals average product safety, at price $p^{NL}=C(0)$: the product is inexpensive but very unsafe. In period 1, consumer of type α therefore chooses ex-ante activity level by maximizing $B(a,\alpha)-aH(0)-C(0)$. Thus, $a_1^{NL,avg}(\alpha)$ (where the superscript *avg* denotes the scenario that consumers know only average product risk) is defined by

$$\frac{\partial B(a,\alpha)}{\partial a} - H(0) = 0. \qquad \text{(C1)}$$

By properties of the function $B(\cdot,\cdot)$, $a_1^{NL,avg}(\alpha)$ increases in α. Also, $a_1^{NL,avg}(\alpha)>0$ for all $\alpha>0$. Thus, $\lim_{\alpha\to 0} a_1^{NL,avg}(\alpha) \geq 0.$ Maximized anticipated net utility of consumer of type α equals

$$U_1^{NL,avg}(\alpha)=\max_a\{B(a,\alpha)-C(0)-aH(0)\}=B(a_1^{NL,avg}(\alpha),\alpha)-C(0)-a_1^{NL,avg}(\alpha)H(0). \qquad \text{(C2)}$$

Applying the Envelope Theorem and using assumption (1), $U_1^{NL,avg}(\alpha)$ is increasing in α. Since for all α

$$U_1^{NL,avg}(\alpha)=B(a_1^{NL,avg}(\alpha),\alpha)-C(0)-a_1^{NL,avg}(\alpha)H(0)<B(\hat{a}(\alpha),\alpha)-C(0)-a_1^{NL,avg}(\alpha)H(0) \qquad \text{(C3)}$$

and $B(\hat{a}(\alpha),\alpha)\to 0$ as $\alpha\to 0$ (see Section 2.1), it follows from (C3) that

$$\lim_{\alpha\to 0} U_1^{NL,avg}(\alpha) \leq -H(0)\lim_{\alpha\to 0} a_1^{NL,avg}(\alpha) - C(0) \leq -C(0)<0. \qquad \text{(C4)}$$

Hence, for α sufficiently small, $U_1^{NL,avg}(\alpha)<0$. Let $\alpha_0^{NL,avg}>0$ be the value of α such that $U_1^{NL,avg}(\alpha)<0$ for $\alpha<\alpha_0^{NL,avg}$, $U_1^{NL,avg}(\alpha_0^{NL,avg})=0$, and $U_1^{NL,avg}(\alpha)>0$ for $\alpha>\alpha_0^{NL,avg}$. That is, because of its risky nature, only consumers with $\alpha\geq\alpha_0^{NL,avg}$ purchase the product. Observe that when either $C(0)$ or $H(0)$ is sufficiently large, $\alpha_0^{NL,avg}$ exceeds the value one and thus it is possible that even consumers who overestimate future product benefits (as long as their overestimation is not extreme) abstain from purchasing the product.

In period 2, all consumers who purchased the product ($\alpha\geq\alpha_0^{NL,avg}$) update their choice of activity level by maximizing $B(a)-C(0)-aH(0)$. Thus, the ex-post choice of activity level for consumer of type $\alpha \geq \alpha_0^{NL,avg}$ equals $a_2^{NL,avg}(\alpha)=a^*(0)$, where the function $a^*(\cdot)$ is defined in Section 2.3. Maximized experienced net utility for consumer of type $\alpha \geq \alpha_0^{NL,avg}$ is independent of α and equals

$$U_2^{NL,avg}=B(a^*(0))-C(0)-a^*(0)H(0). \tag{C5}$$

The following result contrasts $U_2^{NL,avg}$ defined in (C5) with $U_2^{NL}(\alpha)$ defined by expression (10).

Lemma C1: $U_2^{NL,avg}<U_2^{NL}(\alpha)$ *for all* $\alpha \leq 1$.

Proof: For given safety level $x \geq 0$, let

$$U_2^{NL,avg}(x)=\max_a\{B(a)-C(x)-aH(x)\}=B(a^*(x))-C(x)-a^*(x)H(x) \tag{C6}$$

be experienced net utility of the consumer who purchases a product with safety level x at price $p=C(x)$. Note that $U_2^{NL,avg}=U_2^{NL,avg}(0)$. Furthermore, observe that $U_2^{NL}(\alpha)=U_2^{NL,avg}(x^{NL}(\alpha))$. Hence, Lemma C1 can be expressed as $U_2^{NL,avg}(0)<U_2^{NL,avg}(x^{NL}(\alpha))$ for all $\alpha \leq 1$. To complete the proof, we show, first, that $U_2^{NL,avg}(x)$ is increasing for $x \leq x^{FB}$; and second, that $x^{NL}(\alpha)>0$ for any $\alpha>0$. To show that $U_2^{NL,avg}(x)$ is increasing for $x \leq x^{FB}$: by the Envelope Theorem, $dU_2^{NL,avg}(x)/dx=-C'(x)-a^*(x)H'(x)=\Psi(x,a^*(x))$, where the function $\Psi(\cdot,\cdot)$ is defined in the proof of Lemma 2 in Appendix A. Drawing on the analysis in proof of Lemma 2, $U_2^{NL,avg}(x)$ is increasing when $x \leq x^{FB}$. To show that $x^{NL}(\alpha)>0$ for any $\alpha>0$: Suppose not. Then, there exists α_c such that $x^{NL}(\alpha_c)=0$ and, since $x^{NL}(\alpha)$ is increasing (see (A6)), $x^{NL}(\alpha)<0$ for all $\alpha<\alpha_c$. This is a contradiction since $x \geq 0$. Hence, $U_2^{NL,avg}(0)<U_2^{NL,avg}(x^{NL}(\alpha))$ for all $\alpha \leq 1$. □

Observe that $U_2^{NL,avg}$ need not be positive. In fact, it follows from (C5) that when either $C(0)$ or $H(0)$ is sufficiently large, $U_2^{NL,avg}<0$. Thus, when consumers know only average product risk, under no liability consumers who purchase the product ex-post possibly realize negative experienced net utility.

Consider next strict liability. Under this legal regime "customers' estimate of risk will not affect their willingness to make purchases, for they will be compensated for any losses they suffer" (Shavell 1987: 68). Thus, firms choose x in order to minimize $C(x)+aH(x)$. Aware of moral hazard on behalf of consumers, firms rationally predict that $a=\hat{a}$ and choose safety level equal to $x^*(\hat{a})$ (see Section 3.2). Since all firms choose the same level of safety, the average safety equals $x^*(\hat{a})$ and the equilibrium is exactly as characterized in Section 3.2 when consumers possess perfect information about product risks. In particular, only consumers with $\alpha>\alpha_0^{SL}$ purchase the product. $U_2^{SL,avg}(\alpha)=U_2^{SL}(\alpha)$, where $U_2^{SL}(\alpha)$ is defined by (13).

Finally, consider the negligence rule with due standard of safety $x^{NG}=x^{FB}$. With consumers knowing only average product risk, "a firm's choice of *x* will not affect its ability to sell its product" (Shavell 1987: 67). Thus, to minimize costs, *all* firms now optimally choose $x=x^{FB}$ which in turn equals the average safety. Consumers of type $\alpha<1$ then optimally choose ex-ante activity level $a_1^{NG,avg}(\alpha)=\text{argmax}_a\{B(a,\alpha)-C(x^{FB})-aH(x^{FB})\}$. Thus, when $\alpha<1$, $a_1^{NG,avg}(\alpha)=a_1^{NG}(\alpha)$, $U_1^{NG,avg}(\alpha)=U_1^{NG}(\alpha)$, and $a_2^{NG,avg}(\alpha)=a_2^{NG}=a^{FB}$. The equilibrium for $\alpha<1$ when consumers know only average product risk therefore coincides with the equilibrium when consumers possess perfect information about product risk, described in Section 3.3. Consider next consumers of type $\alpha\geq1$. Since

$$\max_a\{B(a,\alpha)-C(x^{FB})-aH(x^{FB})\}\geq B(a^{FB})-C(x^{FB})-a^{FB}H(x^{FB})>0, \tag{C7}$$

where the last inequality follows from (6), all consumers of type $\alpha\geq1$ purchase the product. Furthermore, in period 2, these consumers choose ex-post activity level equal to $a_2^{NG,avg}=\text{argmax}_a\{B(a)-C(x^{FB})-aH(x^{FB})\}=a^{FB}$ and accordingly realize experienced net utility equal to $U_2^{NG,avg}=\Omega^{FB}$. Thus, when consumers know only average product risk, under negligence rule only consumers of type $\alpha>\alpha_0^{NG}$ (where α_0^{NG} is defined in Lemma 4) purchase the product and realize experienced net utility equal to Ω^{FB}.

Which is therefore the comparatively best legal regime from the social welfare standpoint when consumers know only average product risk? Note, first, that for $\alpha>\alpha_0^{NG}$ consumers attain the highest experienced net utility among the three regimes under the negligence rule. Second, more consumers purchase the product under negligence than under strict liability: $\alpha_0^{NG}<\alpha_0^{SL}$. Third, the relationship between α_0^{NG} and $\alpha_0^{NL,avg}$ is in general unclear as is the magnitude of $U_2^{NL,avg}$ versus $U_2^{SL,avg}$ for consumers that purchase the product under both legal regimes (proof omitted). However, for either $C(0)$ or $H(0)$ sufficiently large, $\alpha_0^{NL,avg}>1$ and $U_2^{NL,avg}<0$. Therefore, we have the following result:

Proposition C1: *For* $\alpha\geq\alpha_0^{NG}$, $U_2^{NG,avg}=\Omega^{FB}>\max\{U_2^{NL,avg},U_2^{SL,avg}=U_1^{SL}(1)\}$ *whereas for* $\alpha<\alpha_0^{NG}$, *the relationship between* $U_2^{NG,avg}$ *and* $U_2^{NL,avg}$ *is in general ambiguous. However, when either* $C(0)$ *or* $H(0)$ *is sufficiently large,* $U_2^{NG,avg}=U_2^{SL,avg}=0>U_2^{NL,avg}$ *for* $\alpha\leq\alpha_0^{NG}$ *and thus negligence attains the highest social welfare for any distribution* $F(\alpha)$.

In sum, when consumers know only average product risk the relative attractiveness of no liability decreases from the social standpoint. Intuitively, allocating losses from defective products to consumers when consumers have imperfect information about product risk is clearly suboptimal: a regime that allocates losses from defective products to producers should in general be preferred from the social welfare standpoint. In comparison with strict liability, which is plagued by moral hazard, negligence ensures both wider market coverage and, for those consumers that purchase the product, results in comparatively highest experienced net utility. Thus, when consumers know only average product risk, negligence emerges as the comparatively best legal regime.