EC337: Economics of Legal Issues, Spring 2009

Problem Set #3 Solutions

April 2, 2009

1. **(Torts) (a)** Social Optimum (where C_B^C stands for Bert's costs of care, C_E^C stands for Ernie's costs of care, and D for damages:

Ernie \ Bert	No Care	High Care
No Care	$C_B = 0\ C_E = 0\ D = 40$	$C_B = 6\ C_E = 0\ D = 26$
Some Care	$C_B = 0\ C_E = 5\ D = 32$	$C_B = 6\ C_E = 5\ D = 20$
High Care	$C_B = 0\ C_E = 10\ D = 24$	$C_B = 6\ C_E = 10\ D = 16$

Total social costs $C_B + C_E + D$ are minimized when Ernie takes "Some Care" and Bert takes "High Care". These are also the efficient standards to be considered under the various negligence rules below. For the questions below, the Nash Equilibrium is in brackets.

(b) No Liability: Under this rule, Bert is liable for all damages (since Ernie is liable for none). Each is also responsible for his own costs of care:

Ernie \ Bert	No Care	High Care
No Care	$C_B = 40\ C_E = 0$	$[C_B = 32\ C_E = 0]$
Some Care	$C_B = 32\ C_E = 5$	$C_B = 26\ C_E = 5$
High Care	$C_B = 24\ C_E = 10$	$C_B = 22\ C_E = 10$

Ernie has a dominant strategy "No Care" and Bert has a dominant strategy "High Care"

(c) Strict Liability: Under this rule, Bert is liable for no damages (since Ernie is liable for all). Each is also responsible for his own costs of care:

Ernie \ Bert	No Care	High Care
No Care	$C_B = 0\ C_E = 40$	$C_B = 6\ C_E = 26$
Some Care	$C_B = 0\ C_E = 37$	$C_B = 6\ C_E = 25$
High Care	$[C_B = 0 C_E = 34]$	$C_B = 6\ C_E = 26$

Bert has a dominant strategy "No Care" and Ernie has a dominant strategy "High Care"

(d) Strict Liability with Contributory Negligence: Under this rule, Bert is liable for the damages when he falls below the standard of care (="High Care") and Ernie is liable for the damages otherwise. Each is also responsible for his own costs of care:

Ernie \ Bert	No Care	High Care
No Care	$C_B = 40\ C_E = 0$	$C_B = 6\ C_E = 26$
Some Care	$C_B = 32\ C_E = 5$	$[C_B = 6\ C_E = 25]$
High Care	$C_B = 24\ C_E = 10$	$C_B = 6\ C_E = 26$

Bert has a dominant strategy "High Care" and Ernie chooses "Some Care" as a result.

(e) Negligence: Under this rule, Ernie is liable for the damages when he falls below the standard of care(="Some Care") and Bert is liable for the damages otherwise. Each is also responsible for his own costs of care:

Ernie \ Bert	No Care	High Care
No Care	$C_B = 0$ $C_E = 40$	$C_B = 6$ $C_E = 26$
Some Care	$C_B = 32$ $C_E = 5$	$[C_B = 26$ $C_E = 5]$
High Care	$C_B = 24$ $C_E = 10$	$C_B = 22$ $C_E = 10$

Ernie has a dominant strategy "Some Care" and Bert chooses "High Care" as a result.

(f) Negligence with Contributory Negligence: Under this rule, Ernie is liable for the damages when he falls below the standard of care(="Some Care") and Bert does not fall below the standard of care(="High Care"). Bert is liable for the damages otherwise. Each is also responsible for his own costs of care:

Ernie \ Bert	No Care	High Care
No Care	$C_B = 40$ $C_E = 0$	$C_B = 6$ $C_E = 26$
Some Care	$C_B = 32$ $C_E = 5$	$[C_B = 26$ $C_E = 5]$
High Care	$C_B = 24$ $C_E = 10$	$C_B = 22$ $C_E = 10$

Bert has a dominant strategy "High Care" and Ernie chooses "Some Care" as a result.

(g) (i) Fraction of the damages will Bert bear if Ernie exerts moderate care and Bert exerts no care: Since Ernie does not fall below the standard of care (=Some Care) and Bert does, Bert bears 100% of the damages.

(ii) Fraction of the damages will Bert bear if Ernie exerts no care and Bert exerts no care: Since both fall below their standards, each bears a fraction of the damages according to:

$$\begin{aligned} \text{Ernie's fraction} &: \frac{5-0}{(5-0)+(6-0)} = \frac{5}{11} \\ \text{Bert's fraction} &: \frac{6-0}{(5-0)+(6-0)} = \frac{6}{11} \end{aligned}$$

2. **(Torts and Property)**

(a) Socially optimal level of x for Atlantic:

$$\begin{aligned} \text{Since} &: SC = x^2 + (10,000 - 100x)1 \\ MC &= 2x = 100 = MB \\ \text{so:} &\quad x = 50 \end{aligned}$$

(b) Smallest transfer T that Ernie is willing to accept in order to reduce pollution to the socially optimal level:

$$\begin{aligned} \text{Since} &: C_E(x = 50) = (50)^2 = 2,500 \text{ and } C_E(x = 0) = 0 \\ \text{Then:} &\quad 2,500 - T \leq 0 \text{ or } 2,500 \leq T \end{aligned}$$

In order for Ernie to take care $x = 50$, Bert needs to bribe him enough to make Ernie better off than when he takes care $x = 0$. Largest transfer T that Bert is willing to pay in order to have Atlantic reduce pollution to the socially optimal level:

$$\begin{aligned} \text{Since} &: \quad C_B(x = 50) = (10,000 - 100(50)) = 5,000 \text{ and } C_B(x = 0) = (10,000 - 100(0)) = 10,000 \\ \text{Then} &: \quad 5,000 + T \leq 10,000 \text{ or } T \leq 5,000 \end{aligned}$$

In order for it to be worthwhile for Bert to bribe Ernie into taking care $x = 50$, Bert should not bribe him so much that he is actually worse off compared with the case where Ernie takes care $x = 0$.

(c) (i) Strict liability: Under strict liability, Ernie is liable for all damages to Bert plus his own cost of precaution.

$$\text{Atlantic minimizes: } C_A = x^2 + (10,000 - 100x)1$$

Solution is: $x = 50$ since the problem is the same as part (a). So, he internalizes all social costs and behaves efficiently.

(ii) Negligence (with the socially optimal standard of care for Atlantic): Under negligence, Ernie is liable for all damages to Bert plus his own cost of precaution below the efficient standard $x = 50$ (calculated in part (a)) but only pays his own costs above the efficient standard.

$$\text{Atlantic minimizes: } C_A = \begin{cases} x^2 & \text{if } x \geq 50 \\ x^2 + (10,000 - 100x)1 & \text{if } x < 50 \end{cases}$$

Solution is:$x = 50$ since the bottom half of the problem is minimized as close to 50 as possible. So, he internalizes all social costs and behaves efficiently.

(d)(i) Socially optimal number of A:

$$MC_A = (x^2 + 10,000 - 100x)(2A) = 45,000 = MB_A$$

Since:$x = 50$ is the efficient amount from (a), it follows that $MC_A = MB_A$ can be written:

$$((50)^2 + 10,000 - 100(50))(2A) = 45,000 \text{ or } 15,000A = 45,000 \text{ or } A = 3$$

(d)(ii) Negligence rule (with the socially optimal standard of care for x only):

$$\text{Atlantic maximizes: } U_A = \begin{cases} 45,000A - (x^2)A^2 & \text{if } x \geq 50 \\ 45,000A - (10,000 - 100x + x^2)A^2 & \text{if } x < 50 \end{cases}$$

Under negligence where the standard of care for Atlantic is given in terms of x only, Ernie is liable for all damages to Bert plus his own cost of precaution below the efficient standard $x = 50$ (calculated in part (a)) but only pays his own costs above the efficient standard. Since the optimal choice of x does not depend on A (why not: on the bottom half $MB_A(x) = 2xA^2 < 100A^2 = MC_A(x)$ and on the top half you should choose x as small as possible), it is optimal for Ernie to choose $x = 50$ and

his maximization problem becomes:

$$\begin{aligned} \text{Atlantic maximizes} \quad &: \quad U_A = 45,000A - (2,500)A^2 \\ \text{So:} \quad &\quad MB_A(A) = 45,000 = 5,000A = MC_A(A) \text{ or } A = 9 \end{aligned}$$

Compared with the choice of $A = 3$ in part **(d)(ii),** we can see that Ernie is interested in expanding Atlantic's operations too much.

(e) No: It's not so hard to figure out how much profits each smokestack brings. And it's not hard to observe how many smokestacks Atlantic has. In some sense, this question was a trick all along. The appropriate negligence standard for pollution should be total pollution–not pollution per smokestack and number of smokestacks.

3. **(Causation in Torts)** As long as you made an effort here, I was glad to give full points.