

Economie de la responsabilité civile et pénale

Economics of Tort and Criminal Law

Benjamin Monnery

M2 Economie du Droit / APE, année 2018-2019

GENERAL INFO

Benjamin Monnery, maître de conférences en économie
Chercheur à EconomiX (CNRS)
Bureau 308A bâtiment Maurice Allais
bmonnery@parisnanterre.fr

20H course = six 3-hour lessons + one 2-hour written exam
27-sept 04-oct 18-oct 25-oct 8-nov 15-nov
Class **cancelled on Oct 11**

Exam in late November (22 or 29) + **bonus** throughout semester

Slides will be available on my webpage

BONUS 1 : A LAB EXPERIMENT ON LIABILITY RULES

Bonuses are **individual and non-mandatory**

Angelova, Armantier, Attanasi & Hiriart (2014) : **Relative performance of liability rules : Experimental evidence**, *Theory and Decision* 77(4)

freely available as a CRESE working paper at :
<http://crese.univ-fcomte.fr/WP-2013-03.pdf>

Goal : make a **1-page critical review** of the paper

- very brief summary of the paper (topic, method, main results)
 - discuss method, experimental design, interpretations, conclusions
 - criticisms, shortcomings ?
- bonus based on **quality/clarity/concision**

send PDF by email **before next wednesday (12 :00)** (October 3)
at bmonnery@parisnanterre.fr

REFERENCES

Cooter & Ulen (2016) : Law & Economics 6th ed, *Pearson*

Chapter 6 : An Economic Analysis of Tort Law

Chapter 12 : An Economic Theory of Crime and Punishment

> freely available at <http://scholarship.law.berkeley.edu/books/2/>

Shavell (2004) : Foundations of Economic Analysis of Law, *Harvard*

Chapter 2 : Accident law

Chapter 5 : Public law enforcement and criminal law

> freely available as NBER working papers

Miceli (1997) : Economics of the Law, *Oxford*

Chapter 2 : The Economics of Tort Law

Deffains & Langlais (2009) : Analyse Economique du Droit, *de Boeck*

Chapter 2 : Economie de la responsabilité

Chapter 5 : Analyse Economique de la Criminalité

CONTENT OF THE COURSE

1 Introduction to economic analysis of tort law

- economists' general approach to torts as a problem of efficiency
- basic model and main liability rules
- challenges in practical implementation
- evidence from lab experiments

2 Economic analysis of criminal law, crime-control policies

- theoretical framework(s) for analyzing crime
- stylized facts about crime, recidivism and crime-control policies
- empirical evidence (mostly using econometrics) on different topics (police, legal sanctions, incarceration)

OUTLINE : TORT LAW

- Definitions + Why we need law - and tort law
- Basic model : no liability vs. strict liability in unilateral accident
- Precaution standards and the negligence rule
- Endogenous activity levels
- Setting standards
- Extended model : bilateral accidents
- Experimental evidence
- Limits of liability rules : imperfect information and the judgment-proof problem (insolvency)

Introduction

TORT AND CRIME : DEFINITIONS

- **Tort law** : also known as “accident law”
case between two individuals (plaintiff and defendant)
≠ contract law (when a contract is breached)
≠ property law (tradable property is damaged)

In the U.S., 60% of tort cases involve automobile accidents ; 20% “premises accidents” ; 5% medical malpractice ; 4% products liability

- **Criminal law** :
case between private individual (defendant) and state (prosecutor)

TORT AND CRIME : DIFFERENCES

1. in tort law, litigation between two private individuals
 - ↳ society as a whole/the state is not involved (no social prejudice)in criminal law, the state (prosecutor) confronts private individuals
 - ↳ society as a whole suffers prejudice
2. tort is usually unintentional (it is a byproduct of a risky activity)
 - ↳ impossible to eliminate riskcrime is usually intentional, deliberate
3. a tort can potentially be anything, any harm (no list of "*fautes*")
a crime is a specific offense (*infraction*), sanctioned in the Penal Code
4. standard of evidence (esp. common law) : "preponderance of evidence" in tort
"beyond reasonable doubt" in criminal law
5. tort law and criminal law have different functions

TORT AND CRIME : FUNCTIONS

Tort law intends to :

1. **set the right incentives** for individual behavior in risky activities
 2. **compensate** victim(s) in case of harm
 3. **share risks** across people
- ⇒ the three functions of tort law (Calabresi, 1970)

Criminal law intends to :

1. **deter** potential criminals from engaging in crime
2. **punish** actual criminals with a penalty
3. **retribute** society for the harm suffered
 - ↳ victim can still obtain compensation as "*partie civile*"
4. possibly **incapacitate** criminals for public safety (incarceration, home curfew, restrictions of liberty)

TORT LAW : PRINCIPLES

- Art 1382 Code civil : “Tout fait quelconque de l’homme qui cause à autrui un dommage oblige celui par la faute duquel il est arrivé à le réparer”
 - Art 1383 Code civil : “Chacun est responsable du dommage qu’il a causé non seulement par son fait, mais encore par sa négligence ou par son imprudence”
- **strict liability and fault-based liability** (negligence)
responsabilité sans faute et responsabilité pour faute
- Art 1258 Code civil : “la réparation doit avoir pour objet de replacer la victime autant qu’il est possible dans la situation où elle se serait trouvée si le fait dommageable n’avait pas eu lieu. Il ne doit en résulter pour elle ni perte ni profit.”
- **full compensation of damages** (*principe de réparation intégrale via des dommages et intérêts - ou en nature*)

But **why exactly do we need law** - and tort law in particular ?

The Problem of Social Costs, COASE (1960)

Suppose David organizes small weekly concerts at his house

↳ this activity generates a weekly revenue of 100 euros

His neighbor, however, does not like loud music

↳ he suffers a nuisance equivalent to 20 euros per week

⇒ example of a negative externality

Look at different cases

1. No law
2. Home concerts illegal
3. Negotiation
4. and Tort law

CONSEQUENCES OF LEGAL INSTITUTIONS

Case 1 : No law (no tort law, no property rights)

↳ David is unlikely to consider his neighbor's harm :

- David keeps organizing concerts (+100)
- His neighbor suffers harm (-20)

→ net social wealth is positive (+80)

Problem ?

1. **winner/loser** : the victim is not compensated (unfair)

2. **bad incentives** (leads to inefficient outcomes)

- David would still organize concerts if neighbors have a baby (more harm)
 - he would even organize much bigger concerts (increased revenue but whole neighborhood is annoyed)
- social wealth easily ends up negative

⇒ David maximizes **private payoff** and does not **internalize the social (external) costs** of his activity

CONSEQUENCES OF LEGAL INSTITUTIONS

Case 2 : Law makes home concerts illegal

- David organizes no concert (0)
- His neighbor suffers no harm (0)

→ social wealth is zero

Problem ?

1. net revenue is forgone (inefficient)
2. winner-loser as David loses opportunity to earn money (unfair)

CONSEQUENCES OF LEGAL INSTITUTIONS

Case 3 : Law provides property rights

A. If law protects neighbors' right to quiet nights

- David has to negotiate and offer his neighbor (20+ euros) to be allowed to have concerts
- David makes 75 euros (100-25) and neighbor is compensated (25-20 = 5)

⇒ efficient (social wealth of 80) + fair (win-win) + right incentives

- if neighbors are expecting a child, they will obtain compensation up to the point where social costs = social benefit
if social costs > social benefit (ex : after kid is born), concerts stop
- similarly, David will organize bigger concerts (more revenue but more neighbors annoyed) up to the point where $SC = SB$

CONSEQUENCES OF LEGAL INSTITUTIONS

Case 3 : Law provides property rights

B. If law protects David's right to have home concerts

- Neighbor has to **negotiate** and offer David (up to 20 euros) to stop having concerts
- David refuses, organizes concerts and makes 100 euros (neighbor suffers harm -20)

⇒ **unfair** (winner-loser) + **efficient** (social wealth of 80) + **right incentives**

- if neighbors have a child, they will offer more compensation for David to stop : a win-win agreement is found if $SC > 100$
- similarly, the neighborhood can collectively offer David compensation to not have big concerts

THE COASE THEOREM

derived from *The Problem of Social Costs*, Ronald Coase 1960 (JLE)

Whatever the initial allocation of property rights, efficiency is achieved as long as transaction costs are small

↳ private arrangements on property rights lead to **aggregate wealth maximization**

Examples :

↳ the market for pollution permits

↳ Code civil (art. 2044) : *“La transaction est un contrat par lequel les partis, par des concessions réciproques, terminent une contestation née, ou préviennent une contestation à naître”*

so should law only **guarantee property rights** ?

THE LIMITS OF PRIVATE NEGOCIATION

Problem 1 : initial allocation of property rights matters for fairness
(redistributive impact)

Problem 2 : transaction costs aren't small in many contexts

- difficult, time-consuming to negotiate
- harm/tortfeasor impossible to anticipate (car accident)
- all contracts are incomplete

Problem 3 : some things can't be traded (no tradable property rights)

- non-rival goods (my consumption does not prevent your consumption)
- non-excludable goods (everybody can consume)
- ↳ can't trade right for clean air or right to have two legs

Case 4 : ex-ante regulation (safety rules, restrictions, Pigouvian taxes)

↳ maximum music volume, tax on home concerts

- potential victims don't need to know risks/social costs/tortfeasor
- but require costly controls, regulatory agencies, rich information on costs/benefits to choose optimal parameters

→ **Need for tort law imposing liability :**

- saves transaction costs & regulatory costs (→ litigation costs)
- settles who is liable
- decides how much compensation is needed

NB : in real-life, ex-ante regulation and ex-post tort often coexist

Tort Law

FUNCTIONS OF TORT LAW

Three functions :

- 1 **Compensate the victim/plaintiff** for the harm caused by the tortfeasor/defendant
↳ move V 's utility back to his initial indifference curve through financial compensation
- 2 **Set the right incentives** for efficient accident prevention...
... without *ex-ante* regulation (regulatory costs) or negotiation (transactions costs/incomplete contracts)
- 3 **Share risks across people**

EFFICIENT ACCIDENT PREVENTION

Economists mostly focus on how to obtain efficient deterrence

“The principal function of accident law is to reduce the sum of the cost of accident and the cost of avoiding accidents” (Calabresi 1970)

> efficient accident prevention

> hence minimizing the primary costs of accidents

secondary costs : collect evidence on liability, damage

tertiary costs : administrative costs of making justice

- Questions : which responsibility rules best promote precaution/prevent accident ? which rules are socially optimal when cost is accounted for ? what are the distributional impacts of such rules ?

WHAT EFFICIENCY ?

Pareto-efficient allocation : no other allocation can benefit one player without leaving one other player worse off

↳ no losers

Kaldor-Hicks efficient allocation : no other allocation can increase aggregate wealth

↳ losers could be compensated by winners

WHAT IS A TORT ?

At least 2 players : the **Victim** (*plaintiff*) + the **Injurer** (*defendant*)

Conditions for tort :

- **Harm** : possibly any loss in utility of *V*, tangible or intangible, intentional or unintentional (“accident”)
- **Cause** : *I* must have caused harm in a direct or proximate way
 - ↳ strict liability rule (*responsabilité sans faute*)
- **Breach of duty** : *I* must be “at fault” or negligent in some way
 - ↳ negligence rule (*responsabilité pour faute*)

A BASIC MODEL OF TORT LAW : SET-UP

Imagine an activity involving a risk of accident for victims who are passive (unilateral accident) & who will suffer a damage D (in euros)

ex : a chemical plant vs. residents in the neighborhood

ex : a kindergarden teacher vs. small kids

Assumptions

p(x) probability of accident only explained by level of precaution $x \geq 0$

p(x) decreasing convex function of level of precaution x

$p'(x) < 0$ and $p''(x) > 0$ *first efforts matter, further efforts less so*

C(x) precaution is increasingly costly $C'(x) > 0$ and $C''(x) > 0$

first efforts are cheap, further efforts are costly

Injurer is risk-neutral

NB : x as self-protection here. x could also reduce D (self-insurance)

PRECAUTION UNDER NO LIABILITY

If I is never liable for the accident (no tort law), I doesn't have to pay compensation

He simply solves $\min C(x)$ and chooses $x = 0$

↳ I externalizes the cost of accidents

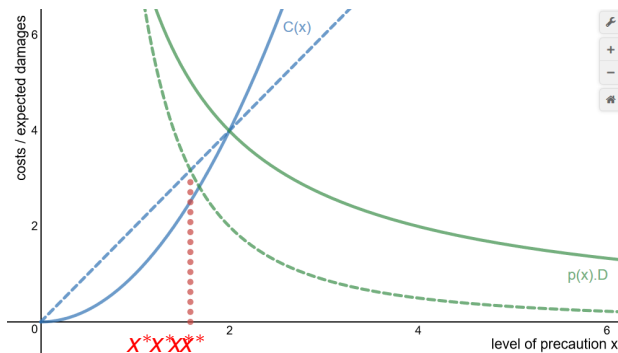
Under no liability, I takes no precaution, which is socially-inefficient.
Why ?

SOCIAL OBJECTIVE

Objective of the government : Find the optimal level of precaution x^* that minimizes the social cost of accidents (SC)

$$\min_x SC = C(x) + p(x)D \quad (1)$$

minimize the sum of the costs of accidents and of avoiding accidents (primary costs)

GRAPHICAL SOLUTION x^* 

with $C(x) = x^2$ $p(x) = 1/x$ $D \in \{2, 4, 6, 8\}$

Optimal level of precaution x^*

> Intersection of **marginal cost** and **marginal benefit**

> As damages increase, so does the optimal level of precaution

ANALYTICAL SOLUTION x^*

The solution to

$$\min_x SC = C(x) + p(x)D \quad (1)$$

is given by

$$SC'(x) = 0 \Leftrightarrow C'(x) + p'(x)D = 0 \quad (\text{FOC})$$

$$SC''(x) > 0 \Leftrightarrow C''(x) + p''(x)D > 0 \quad (\text{SOC})$$

↳ Optimal precaution x^* when **marginal cost = marginal benefit**

Resolution with $C(x) = x^2$ $p(x) = 1/x$ $D = 2$, we get

$$2x + (-1/x^2)2 = 0 \Leftrightarrow x^* = 1$$

How can tort law enforce this optimum ?

EFFICIENT PRECAUTION BY I?

Strict Liability with Full compensation

If there is liability and I has to pay for D (full compensation) :

He solves $\min C(x) + p(x)D$ (like the government) and chooses the socially optimal $x^* = 1$

↳ / internalizes the costs of accidents

Another solution is **fault-based liability : the negligence rule**

Negligence rule

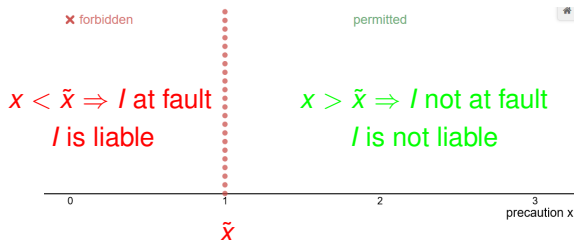
THE NEGLIGENCE RULE

Recall the conditions for tort

- Harm
- Cause
 - ↳ strict liability rule (*responsabilité sans faute*)
- Breach of duty : I must be “at fault” or negligent in some way
 - ↳ negligence rule (*responsabilité pour faute*)

WHEN IS DEFENDANT AT FAULT/NEGLIGENT ?

- Let's measure I 's **level of precaution** as a continuous variable x
- and call \tilde{x} the **duty of care or due care**, i.e. the legal standard (minimum level of precaution warranted)
 - determined by explicit safety rules (e.g. speed limits, chemical composition) or more implicit social conventions



NB : even if $x > \tilde{x}$, I would be liable under strict liability rule

OPTIMAL PRECAUTION UNDER NEGLIGENCE RULE AT \tilde{x}

Assume legislator sets legal standard for l at social optimum ($\tilde{x} = x^*$)

Objective : l choose the socially-optimal x^*

Under negligence rule, l wants to minimize expected costs K such that :

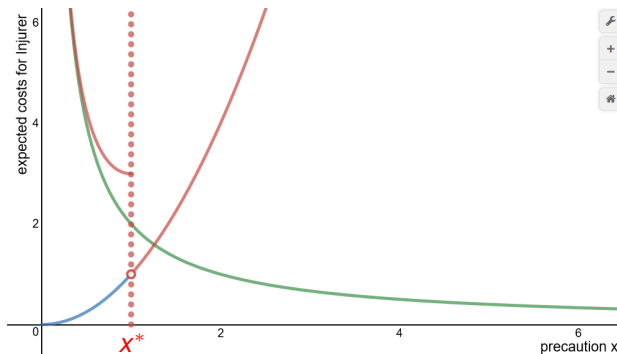
$$K(x) = \begin{cases} C(x) + p(x)D & \text{if } x < \tilde{x} \\ C(x) & \text{if } x \geq \tilde{x} \end{cases} \quad (1)$$

Solution : l chooses $x = \tilde{x} = x^*$

↳ minimum level of precaution to escape liability (i.e. social optimum)

Intuition : $C(x) < C(x) + p(x)D$ (l always wants to escape liability...) and $C'(x) > 0$ (... at the lowest cost which is \tilde{x})

GRAPHICAL SOLUTION UNDER NEGLIGENCE RULE



with $C(x) = x^2$ $p(x) = 1/x$ $D = 2$

Negligence rule yields a discontinuity in expected costs K
 $\hookrightarrow I$ chooses x^* , minimum level of precaution to escape liability

SUMMARY FOR UNILATERAL ACCIDENT

Both **strict liability** (with full compensation) and the **negligence rule** (with due care = x^*) lead to **socially-efficient precaution** by I
 ↳ the “**rule equivalence**”

Whereas **No liability** leads to **no precaution** (socially suboptimal)

However, differences between *SL* and *NR* in :

- amount of information needed by the court : only evaluate damages with *SL* vs. evaluate care taken and socially-optimal care with *NR* (hence administrative costs)
- risk allocation : in *SL*, I bears all the risk while in *NR*, V does
- if precaution is multidimensional, efficient incentive on all dimensions with *SL* while *NR* only provides incentives for measurable dimensions

Next : endogenous activity + bilateral accident

Do we observe such precaution behavior in **lab experiments** ?

BONUS 1 : A LAB EXPERIMENT ON LIABILITY RULES

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Relative performance of liability rules : Experimental evidence

Goal : test key predictions of basic unilateral accident model

1. precaution by injurer is larger with liability than with no liability
2. precaution does not differ between strict liability and negligence
3. precaution is not affected by larger damages when injurer becomes insolvent ($D > Wealth$)

Note those hypotheses are “weaker” than theoretical predictions

Method : a lab experiment with ≈ 180 german students

- Participants earn money at beginning by solving math problems
- then they make 10 decisions of precaution (which is costly) to prevent the risk of an accident (from 5% to 1%) harming others
- 6 situations, i.e. 6 treatments (30 participants in each)
 - 3 liability rules : NoLiability *NoL*, StrictLiability *SL*, Negligence *Ne*
 - 2 levels of damages : *Low* or *High* (limited liability case)

MAIN RESULTS

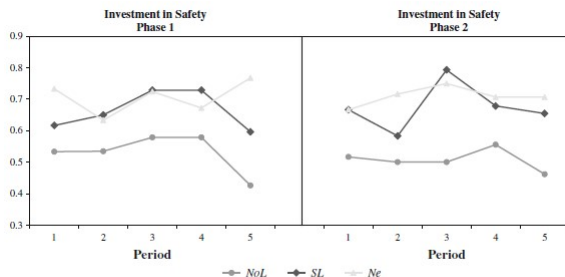


Fig. 2 Investment in safety decisions over time (in %), by liability rule (pooled for ability to compensate the victim)

1. More participants take precaution under liability (SL or Ne) than without liability (NoL)
↳ panel logit : ≈ 30 pts gap in proba of taking precaution
 2. No significant difference in precaution between SL and Ne
- ⇒ Those effects are mostly driven by selfish people

MAIN RESULTS

Table 4 Investment ratio by treatment

Treatment	NoL-low	NoL-high	SL-low	SL-high	Ne-low	Ne-high
Average investment ratio (SD)	0.47 (0.38)	0.53 (0.39)	0.68 (0.36)	0.64 (0.34)	0.69 (0.39)	0.72 (0.33)

3 No difference in precaution if I is able to fully compensate damage ($D = \text{Low}$) or not ($D = \text{High}$)

↳ participants do not care a lot about the victim (full vs. partial compensation)

⇒ illustrates the *judgment-proof problem* : when injurers are protected by limited liability, they do not take more care to avoid larger damages (socially suboptimal)

CONCLUSION ON BASIC UNILATERAL ACCIDENT

Remember : Economic theory predicts that liability rules (either *SR* and *NR*) induce socially-efficient precaution by injurers in unilateral accident (whereas No Liability induces no precaution)

This lab experiment provides partial confirmation :

- There is more precaution when I have to compensate *V* : **tort law seems to be effective** (provides incentives for more precaution)
 - But even without liability, some people take **costly precaution to protect victims**
 - *SL* and *NR* are as effective : supports **the “rule equivalence”**
 - However, **tort law does not seem to be socially efficient** : it does not induce everybody to choose socially-optimal precaution level
 - ↳ So **why do (some) people behave differently than predicted ?**
Social preferences (altruism...), limited rationality, biases (overconfidence...)
- ⇒ topic of second Bonus

BONUS 2 : AN EXPERIMENT ON LIABILITY RULES AND SOCIAL NORMS

Bonuses are individual and non-mandatory

Deffains, Espinosa & Fluét (2017) : [Laws and Norms : Experimental evidence with liability rules](#), *working paper*

freely available as a CRREP working paper (June 2017)

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LAWS AND NORMS

Lab experiment to test the interplay between **liability rules and social norms**

N = 196 students from Strasbourg and Quebec

5 treatments :

- No liability, Strict Liability, Negligence Rule
- + Severe Law ($p = 1$), Mild Law ($p = 0.5$)
- NL, SSL, SNR, MSL, MNR

20 rounds (each time with 4 new, random, anonymous players) :

1. choose action X or Y and possibly suffer legal sanctions
2. express disapproval or not

(10 times with monetary sanctions + 10 times with symbolic ones)

Y = private income of 6 ECU, no social loss

X = random income (either $A=14$, $B=16$, $C=20$ or $D=22$, with 25% probability), loss of 4 ECU for all 3 other players

PAYOFFS AND PREDICTIONS

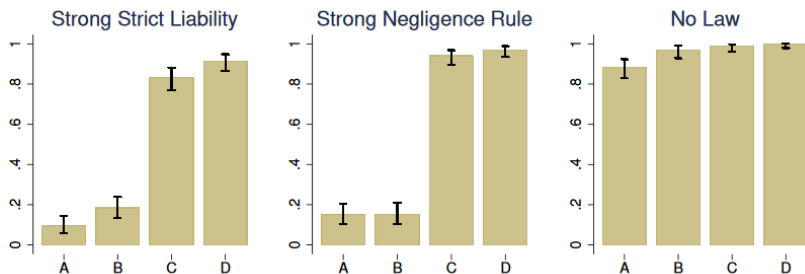
- Under SSL : get 6 if choose Y
 - get payment - 12 if choose X (less than 6 in A & B, more than 6 in C & D)
- Under SNR = get 6 if choose Y
 - get payment and no compensation if state C or D (20 or 22), and get payment and compensate if state A or B and lose money if others played X with C or D (14-12-... or 16-12-...)
- Under mild law, same but with proba of enforcement of 0.5.
Liability is never deterrent : should play X

Theoretical predictions :

- No Liability and Mild Law are non-deterrent (play X)
- Under Strong Law, SL and NR induce efficient behavior

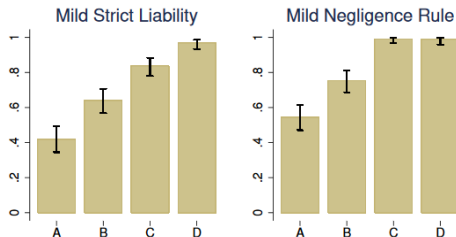
RESULTS 1

Figure 1: Proportion of X actions across treatments and situations.



- NoLaw : everybody chooses X (self-interest)
- SL : i has to compensate others (-12)
 - if income is low (A or B), most play Y (6 ECU for sure)
 - if income is high (C or D), most play X (20-12 or 22-12)
- NR : only compensate others in cases A or B (same results)

RESULTS UNDER MILD LAW



- All participants play X when no compensation (NR C & D)
 - But some play Y under NR A & B even though expected payoff is larger with X
 - And many play Y under SR A & B even though X is more profitable
- ⇒ people care a lot about others' losses

MODEL OF PREFERENCES

Charness and Rabin (2002) :

$$u_i = (1 - \lambda_i)\pi_i + \lambda_i \sum_j \pi_j$$

where π_i = private payoff

π_j = social payoff

λ_i = weight given to efficiency concerns (i.e. to others)

Extensions :

δ_i = pure reluctance to cause harm (even when harm is compensated)

λ_{ir} = social preferences can be rule-specific

RESULTS 3

Model	Restrictions	γ	λ_{NL}	λ_{SL}	λ_{NR}	δ	LL
(1)	$\lambda_{NL} = \lambda_{SL} = \lambda_{NR} = \delta = 0$	.299*** (.01)					-1439.1
(2)	$\lambda_{NL} = \lambda_{SL} = \lambda_{NR}; \delta = 0$	.471*** (.019)	.391*** (.022)	.391*** (.022)	.391*** (.022)		-1366.9
(3)	$\lambda_{NL} = \lambda_{SL} = \lambda_{NR}$	.46*** (.019)	.349*** (.033)	.349*** (.035)	.349*** (.035)	-.273* (.158)	-1365.4
(4-a)	$\lambda_{NL} = \lambda_{NR}$	.464*** (.019)	.319*** (.035)	.488*** (.045)	.319*** (.035)	-.141 (.045)	-1357
(4-b)	$\lambda_{NL} = \lambda_{SL}$	.46*** (.02)	.351*** (.035)	.351*** (.035)	.344*** (.044)	-.276* (.159)	-1365.4
(5)	none	.463*** (.019)	.278*** (.044)	.498*** (.046)	.374*** (.044)	-.078 (.162)	-1355

Significance level: *** significant at 1% level; ** significant at 5% level; * significant at 10% level.

- Under No law, players put some weight on others ($\lambda = 0.28$)
 - However, liability triggers some “norm-activation”
 - under SL, weight on others is 0.5
 - under NR, 0.37
- hence the mere existence of liability rules (excluding payoff consequences) make people pay more attention to others

SUMMARY

“Under Severe Law, in circumstances where self and group interests conflict, strict liability and the negligence rule do indeed efficiently regulate behavior. Both rules do much better than No Law, as would be expected if individuals had purely self- interested preferences. However, under Mild Law, both liability rules still do significantly better than No Law even though the threat of legal sanction is essentially nondeterrent. Moreover, strict liability then does better than the negligence rule even though monetary incentives are the same under both rules when private and collective interests are at odds.”

Key points :

- participants partially tradeoff private benefit with social losses
- tort law has a “norm-activation” effect (makes people care about others’ losses)
- such norm-activation is stronger under SL
- participants respond to social disapproval (symbolic or costly punishment)

Endogenous activity levels

ENDOGENOUS ACTIVITY : SETUP

In real-life, expected cost of accident often depends on both

- precaution x exerted by potential tortfeasor
- activity level y of tortfeasor

Example : imagine a cargo ship transporting oil, with a probability p of sinking and contaminating oceans. p depends on safety measures x ($p'(x) < 0$), while D (damage caused by the oil spill) depends on volume of oil transported y

Therefore the expected cost of an accident is $p(x).D(y)$
with $D'(y) > 0$ and $D''(y) < 0$

Firm's profit B depends on volume with $B'(y) > 0$ and $B''(y) < 0$

Social objective :

$$\max_{x,y} B(y) - C(x) - p(x)D(y)$$

ENDOGENOUS ACTIVITY

Socially-optimal precaution and activity levels are given by :

$$B'(y) = p(x)D'(y) \quad (\text{FOC1})$$

$$C'(x) = -p'(x)D(y) \quad (\text{FOC2})$$

yielding a unique interior solution (x^*, y^*)

... such that, **at social optimum** :

marginal benefit of more y = marginal expected damage of more y (1)

marginal cost of more x = marginal expected benefit of more x (2)

Which liability rules achieve such optimum (y^*, x^*) ?

NUMERICAL EXAMPLE

Assume $B(y) = \sqrt{y}$, $C(x) = x^2$, $p(x) = 1/x$ and $D(y) = 0.5\sqrt{y}$

Social objective :

$$\max_{x,y} \pi = \sqrt{y} - x^2 - \frac{1}{x} 0.5\sqrt{y}$$

$$\frac{\partial \pi}{\partial y} = 0 \Leftrightarrow \frac{1}{2\sqrt{y}} - \frac{1}{4x\sqrt{y}} = 0 \Leftrightarrow 2\sqrt{y} = 4x\sqrt{y} \Leftrightarrow x^* = 0.5 \quad (\text{FOC1})$$

$$\frac{\partial \pi}{\partial x} = 0 \Leftrightarrow -2x - \frac{0.5\sqrt{y}}{x^2} = 0 \Leftrightarrow 2x^3 = 0.5\sqrt{y} \Leftrightarrow y^* = 0.25 \quad (\text{FOC2})$$

Which liability rules achieve such optimum ($y^* = 0.25$, $x^* = 0.5$) ?

LIABILITY RULES

Under no liability, I solves $\max B(y) - C(x)$
 and chooses y maximal ($+\infty$) and x minimal ($x = 0$)
 → not socially-optimal

Under strict liability, I solves the governments' problem

$$\max_{x,y} B(y) - C(x) - p(x)D(y)$$

and chooses social optimum ($y = y^*$; $x = x^*$)

Under negligence rule...

UNDER NEGLIGENCE RULE (WITH $\tilde{x} = x^*$)

I wants to maximize his profit function π :

$$\pi(x, y) = \begin{cases} B(y) - C(x) - p(x)D(y) & \text{if } x < \tilde{x} \\ B(y) - C(x) & \text{if } x \geq \tilde{x} \end{cases} \quad (2)$$

Same reasoning as before :

I chooses $x = \tilde{x} = x^*$ (socially-optimal precaution)

But... chooses y too high ($y > y^*$) (socially-harmful production)

Under negligence rule, I exerts **due care** (to escape liability) but **produces too much** (because there is no standard on activity level)

\Rightarrow overall, *NR* not socially optimal here since the victim obtains no compensation for too-large damages

INEFFICIENCY OF NEGLIGENCE RULE

Why not establish a **standard of activity** (\tilde{y}) similar to standard of care ?

More **difficult to estimate** \tilde{y} than \tilde{x} :

→ need to know the exact technology of each firm, costs

Hence, in practice, **Strict Liability is preferred to Negligence Rule** in several contexts of unilateral accidents :

ex : product liability, industrial accidents, oil spills...

Note that...

- It is different when victims can take precaution : **bilateral accidents**
 - Even under *SL*, some difficulties can remain such as injurer insolvency ($D > \text{wealth}$)
- argument for **mandatory insurance** (oil cargos, car drivers...)

Setting Legal Standards of Precaution

HOW TO SET LEGAL STANDARD \tilde{x} TO x^* ?

In practice, very hard to use the socially-optimal standard \tilde{x} because :

- precaution is multi-dimensional
- true functions ($C(x)$, $p(x)$) are not observable / hard to estimate
- people are heterogeneous hence optimal precaution is individual-specific

Courts resort to rather vague rules, e.g. the “pater familias” rule, the “reasonable man” rule :

↳ No Negligence if I did “what a reasonable person would do under the same or similar circumstances”

- leaves lots of discretion to judges/legal practice
- doesn't account for heterogeneity in ability to avoid accident
- ⇒ hence sub-optimal. Why ?

THE EFFICIENCY-COST OF APPLYING AVERAGE STANDARDS

Legal standard set as the **optimal care for the average person** (with cost $C(x) = x^2$) $\tilde{x} = \bar{x}^*$

Example : suppose three bus drivers work on the same bus line, A has done it for 20 years, B for one year, C is on first day. All three are held liable by same standard \tilde{x}

- experienced bus driver A is well trained, know the itinerary perfectly, know which spots are dangerous...
- hence low cost of precaution $C_A(x) = 0.5x^2$
- inexperienced bus driver C needs to be much more focused to obtain the same actual level of precaution (accident prevention)
- he ends up exhausted at the end of the day : precaution is much more costly hence $C_C(x) = 10x^2$
- B is in the middle $C_B(x) = 2x^2$

Social objective : $\min C_i(x_i) + p(x_i).D \quad \forall i$

Social-welfare maximization requires that

$$C'_i(x_i) = -p'(x_i).D \quad \forall i \quad (FOC_i)$$

hence people differ in their optimal precaution x_i^*

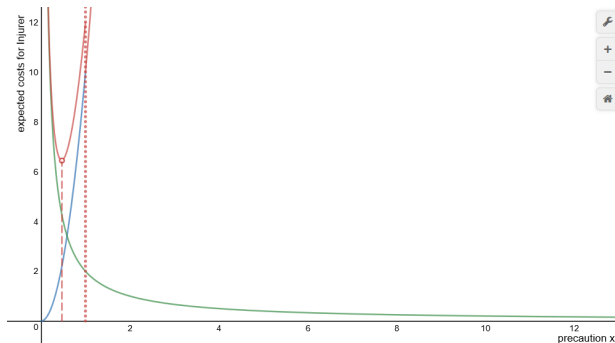
- A with low-cost of effort (experienced driver) should choose $x > \tilde{x}$.
- B and C with high-cost of effort (inexperienced drivers) should choose $x < \tilde{x}$.

However, under *NR* at \tilde{x} :

- A only chooses $x_A = \tilde{x}$ to escape liability
- ⇒ A invests too little in precaution
- B chooses $x_B = \tilde{x}$ to escape liability
- ⇒ B takes too much precaution
- C chooses x_C^* because \tilde{x} is too far/costly compared to benefit of escaping liability
- ⇒ C chooses optimal level in precaution but is held liable

ILLUSTRATION WITH DIFFERENT COSTS OF EFFORT

Recall previous example : $C(x) = x^2$ $p(x) = 1/x$ $D = 2$
 $C(x) = x^2$ is now the **average cost function**, so standard set at $\tilde{x} = 1$



Under *NR*, the **average individual** follows social optimum...
 ... the **inexperienced Driver C** (with high cost $C_C = 10x^2$) should and does exert 0.46 the socially-optimum level

THE EFFICIENCY-COST OF APPLYING AVERAGE STANDARDS

The use of a unique, “blind” standard of care leads to **inefficient precaution**

- either too little precaution, hence too many accidents (if there are many A in the population)
- or too much precaution, hence too few accidents (if there are many B in the population)

More individualized rules are available, e.g. **the Hand rule**

↳ U.S. Judge Learned Hand : the cost of untaken precaution must be greater than the expected social benefit to escape liability

→ such individualized standards are demanding in terms of information/expertise

In practice, tort law can allow consideration of individual specificities (abilities, age...)

Bilateral accidents

BILATERAL ACCIDENTS

In many situations, both potential injurers and potential victims can take precaution

- either sequentially (subgame perfect Nash equilibrium)
 - or simultaneously (Nash equilibrium)
-
- two car drivers
 - driver and cyclist
 - manufacturer and consumer, etc.

What are the implications for tort law ?

BILATERAL ACCIDENT

Social welfare is maximized when

$$\min_{x_i, x_v} SC = C_i(x_i) + C_v(x_v) + p(x_i, x_v)D$$

In a simultaneous game, it yields :

$$SC'(x_i) = 0 \Leftrightarrow C'_i(x_i) + p'(x_i, x_v)D = 0 \quad (\text{FOC1})$$

$$SC'(x_v) = 0 \Leftrightarrow C'_v(x_v) + p'(x_i, x_v)D = 0 \quad (\text{FOC2})$$

Solving the best-response functions ($x_i^* = f(x_v^*)$ and vice versa), we obtain a Nash equilibrium

An interior solution (likely) exists with ($x_i^* > 0; x_v^* > 0$)

↳ social optimum requires both players to take precaution

BILATERAL ACCIDENT : NUMERICAL EXAMPLE

$$\min_{x_i, x_v} SC = x_i^2 + x_v^2 + \frac{1}{x_i x_v} D$$

Solution

$$SC'(x_i) = 0 \Leftrightarrow 2x_i + \frac{-x_v}{(x_i x_v)^2} D = 0 \Leftrightarrow 2x_i^3 = \frac{D}{x_v} \Leftrightarrow x_i^* = \left(\frac{D}{2x_v}\right)^{1/3} \quad (\text{FOC1})$$

$$SC'(x_v) = 0 \Leftrightarrow 2x_v + \frac{-x_i}{(x_i x_v)^2} D = 0 \Leftrightarrow x_v^* = \left(\frac{D}{2x_i}\right)^{1/3} \quad (\text{FOC2})$$

We obtain that $x_i^* = x_v^*$, which gives

$$x_i^* = x_v^* = \left(\frac{D}{2}\right)^{1/4} > 0$$

BILATERAL ACCIDENT UNDER NO LIABILITY AND STRICT LIABILITY

Neither *no liability* nor *strict liability* are satisfactory

↳ *No Liability* leads *I* not to take precaution ($x_I = 0 < x_I^*$), *V* suffers all the risk

↳ *Strict Liability* leads *V* not to take precaution ($x_V = 0 < x_V^*$), *I* suffers all the risk

Obtaining optimal bilateral precaution x_I^* and x_V^* requires some sharing of risk/liability
⇒ the negligence rule

OPTIMAL BILATERAL PRECAUTION UNDER NEGLIGENCE RULE

Assume legislator sets legal standard for I at social optimum ($\tilde{x}_I = x_I^*$)
 there exists a solution to cost-minimization problem

Objective : both I and V choose the socially-optimal x_I^* and x_V^*

Under negligence rule, I wants to minimize his expected costs

$$K_I(x_I) = \begin{cases} C_I(x_I) + p(x)D & \text{if } x_I < \tilde{x}_I \\ C_I(x_I) & \text{if } x_I \geq \tilde{x}_I \end{cases} \quad (3)$$

Solution : I chooses $x_I = \tilde{x} = x_I^*$

↳ the minimum level of precaution to escape liability

V anticipates x_I^* (where I is not liable and V receives no compensation) and plays his best response

↳ V chooses optimal precaution x_V^*

BEYOND SIMPLE NEGLIGENCE RULE

For now, legal standard of precaution only applied to injurers (\tilde{x}_i)

↳ the simple negligence rule

However, seems reasonable to also **make negligent victims liable**

- **Negligence rule with defense of contributory negligence :**
Negligent I escapes liability if V is also negligent
 - **Comparative negligence rule :**
Both I and V are negligent and share the damages in proportion to the contribution of their negligence to the accident
 - **Strict Liability with defense of contributory negligence :**
 I escapes strict liability if V is negligent (ex : manufacturers)
- ⇒ If the legal standards (\tilde{x}_i, \tilde{x}_v) are set at optimal levels and there is full compensation of damages, **these four rules all lead to socially-efficient precaution by both parties**
the equivalence rule

The limits of liability and what to do about it

MAIN LIMITS TO EFFICIENT LIABILITY RULES

- **Imperfect information** by the court
 - to detect harm (e.g. long-term health issues)
 - to measure damages accurately (mismeasurement)
 - to set legal standard optimally
- **Imperfect detection / enforcement**
 - can be difficult to find tortfeasor, prove cause (solution : punitive damages)
 - small losses for many victims : no individual incentive to go to court (solution : class actions)
- **Judgment-proofness : insolvent injurers**
 - either sincere or strategic insolvency (solution : mandatory insurance, extended liability)

THE CASE FOR PUNITIVE DAMAGES

The court can set **punitive damages** in addition to compensatory damages. Two main rationales for this :

1. **punishment** : court judges that *I* acted in a clearly negligent way, intentionnally putting others at risk
↳ deviates from principles of tort law (→ criminal law)
2. **incentives** : in real-life, the occurrence of harm/accident usually does not systematically trigger compensation
 - possibility that victims' harm is not large enough to induce filing a complaint (→ class actions)
 - possibility that, even after complaint, injurer can not be detected/identified or held liable (causality uncertain)
 ↳ $p(x)D$ only occurs with probability $\beta < 1$, hence lower incentive for precaution by *I* (lower deterrence)

⇒ Adding **punitive damages** can reinforce incentives for socially-optimal behavior when enforcement is imperfect (in practice, can also be paid to the state : *amende civile*)

OPTIMAL LEVEL OF PUNITIVE DAMAGES

The government seeks to obtain from / the socially-optimal precaution x^* even though detection is imperfect

$$\arg \min C(x) + p(x)\beta(D + \omega) = x^* \quad (4)$$

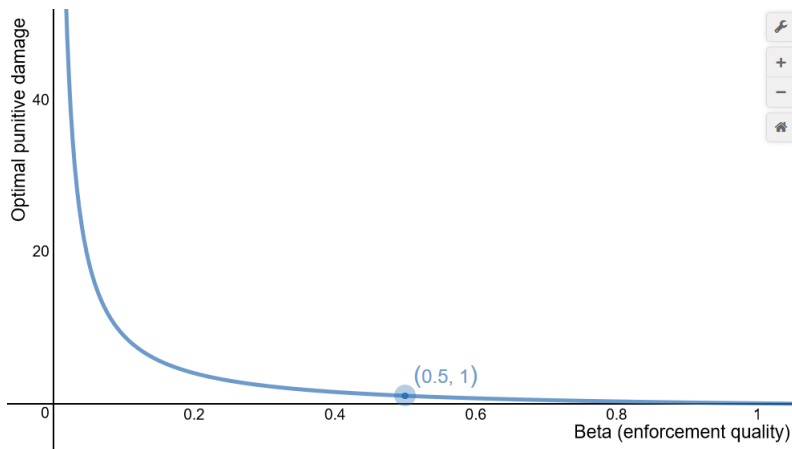
The optimal punitive damage ω^* is such that

$$C'(x) = -p'(x)\beta(D + \omega) \quad (5)$$

Remember that under perfect enforcement, we had $C'(x) = -p'(x)D$ thus (perfect enforcement) $D = \beta(D + \omega)$ (imperfect enforcement)

$$\omega^* = \frac{(1 - \beta)}{\beta} D$$

Optimal level of punitive damages depends on β (how good/bad is enforcement)

OPTIMAL LEVEL OF PUNITIVE DAMAGES ω^* FOR $D=1$ 

If $\beta = \frac{1}{2}$ (enforcement with 50% chance), $\omega^* = 1 * D$

The socially-optimal total compensation ($D + \omega$) should be $2 * D$ (2x actual harm)

THE JUDGMENT-PROOF PROBLEM

In practice, even though a tortfeasor is found liable in court, he can **escape full liability if $D > Wealth$**

ex : serious environmental accidents (oil spills, chemical accidents...), deadly accidents (AZF, Mont-Blanc tunnel)

Under **Strict Liability**, such insolvent injurers do not internalize the total (expected) costs of accidents...

... but only **the costs they will actually pay back** :

$$\min_x K(x) = C(x) + p(x).min[D, W]$$

⇒ when $D > W$, I takes **too little precaution**

Under **Negligence rule**, the judgment-proof problem does not disappear except for *some* injurers

CONSEQUENCES

- Potential injurers do not exert enough precaution compared to social optimum
- ... produce too much (excessive activity)
- ... take suboptimal insurance decisions

Insolvency can be sincere or strategic (big corporations) :

- industrial desagregation : outsourcing of dangerous activities (e.g. oil transportation)
- financial substitution : use debt instead of equity
- preemptive exit : exit market before harm is detected

⇒ the “death of liability” (Lopucki 1996) ?

SOLUTIONS TO JUDGMENT-PROOF PROBLEM

- ex-ante regulation of activities (costly controls)
- solvency norms (e.g. Basel rules)
- mandatory insurance (risky for insurers + lack of historical data to set prices)
- extended liability (e.g. oil cargos)

Economie de la responsabilité civile et pénale

Economics of Tort and Criminal Law

Benjamin Monnery

M2 Economie du Droit / APE, année 2018-2019