

# Regulation, liability and insurance as risk treatment mechanisms

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## Context: historical risk treatment mechanisms



THE PATENT SAFETY RAILWAY BUFFER.

*How to Ensure against Railway Accidents*

John Tenniel, *Punch*, July 1857

Attaching the director to the front of the train  
to promote safety

(Punch was a satirical British weekly magazine  
established in 1841, which closed in 2002)

# Context

- ▷ Society uses multiple mechanisms to control the risk of hazardous activities:
  - **regulation**: technological or organizational prescriptions
  - **liability regimes** such as tort law: obligation to compensate victims
  - **soft law** and self-regulation: voluntary standards of behaviour associated with social sanctions for firms that do not engage in the process
  - **insurance** to ensure that victims are compensated for (the monetary component of) losses
- ▷ Questions:
  - what are the advantages and disadvantages of each mechanism?
  - to what extent are they complementary?

# Regulation: definitions



- ▷ Regulation:
  - obligations imposed by public law designed to induce individuals and firms to outcomes which they would not voluntarily reach, but are in the public interest
  - is enforced by public officials
  - compliance is aided by the threat or imposition of some sanction (fines, closure of activity...)
  - another definition: safety controls used by the regulator
- ▷ Risk regulation: public management of hazards which could affect public health, safety and the environment
  - is roughly half of EU legislation...

# Categories of safety regulation

- ▷ **Prescriptive** or “command and control”
- ▷ **Goal-based** or performance-based
- ▷ **Activity-based**: require firms to implement processes such as an SMS
- ▷ **Information-based**: labelling standards and obligation to disclose information on hazards

*In practice, a mix of these approaches is often used*

# Prescriptive safety regulation



- ▷ Terminology: **prescriptive** or “command and control” or compliance-based regulation
- ▷ Regulator sets specific requirements for regulated firms
  - technological measures, design features for equipment
- ▷ “One size fits all” approach (same requirements for all firms)
- 😊 Allows clarity in requirements and fairness
- 😞 Technological innovation leads to outdated regulations
- 😞 Prevents innovation in safety mechanisms
- 😞 Fairly high cost of verification
- 😞 Regulators do not always have good information on risks or on costs and benefits of safety investments

# Prescriptive safety regulation: examples

- ▷ Passenger cars sold in EU must be equipped with ABS since 2007
- ▷ All oil tankers entering US ports must have a double hull design (since 2006)
- ▷ EU Machinery Directive (2006/42/EC) states that “machinery must be fitted with one or more emergency stop devices to enable actual or impending danger to be averted”
- ▷ Pressure Equipment Regulations state that a pressure vessel must have a written scheme of examination (inspections and their frequency) which is checked by a Competent Person (certified knowledge)



# Prescriptive regulation and technological change

- ▷ Prescribing specific technological solutions hinders innovation concerning safety mechanisms
- ▷ Safety regulations tend to become outdated due to technological change
- ▷ Example: decades-old regulations managed by US Department of Transport
  - USA: cars must have a high and a low beam, and nothing else
  - prevents manufacturers from introducing innovative new headlight designs which detect the presence of incoming traffic and adapt beam shape to avoid dazzling incoming drivers



# Goal-based safety regulation



- ▷ Terminology: goal-based or “performance-based” regulation
- ▷ Regulator establishes specific desired, **measurable outcomes** for regulated activities, without requiring specific ways of achieving them
- 😊 Allows firms to select most effective measures to reach objective
- 😊 Since local managers make decisions on risk treatment measures, better ownership than if measures required by regulator
- 😞 Can be difficult to identify relevant observable outcomes
- 😞 Can encourage a “checklist approach” to safety management

# Goal-based safety regulation: examples

- ▷ US OSHA's "general duty standard":

“ *Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.* ”

- ▷ Civil aviation: probability of catastrophic failure must be  $< 10^{-9}$  per flight hour

# Goal-based safety regulation: problems

- ▷ Stakeholders and NGOs may perceive goal-based safety regulations as being “soft on industry”
- ▷ Stakeholder concerns may arise from:
  - the possibility of using a variety of means of compliance
  - different “standards” being applied for accepting alternative means of compliance
  - different approach & methods to define and measure safety performance
  - more discretion provided to authorities for applying enforcement actions

# Activity-based safety regulation



- ▷ Terminology: activity-based or “management-based”
- ▷ Regulator identifies key processes that are expected to lead to safety performance and requires regulator to implement them effectively
- 😊 Allows regulator to observe and discuss management-level activities in regulated firms
- 😞 Not necessarily effective in ensuring good safety performance

## Activity-based safety regulation: examples

- ▷ Seveso II directive (EU): operators of top tier sites must implement a safety management system (SMS)
- ▷ *Hazards Analysis and Critical Control Points* (HAACP) standards in food safety
  - organizations must undertake hazard analysis, identify critical control points, establish monitoring requirements, establish corrective actions, audit correctness and keep records
- ▷ US EPA's "risk management planning" (RMP) regulations
  - regulations that concern facilities holding more than a threshold quantity of a regulated substance in a process
- ▷ US OSHA's "process safety management" (PSM) regulations

# Process Safety Management (USA/OSHA)



- ▷ US federal regulation concerning the management of hazards associated with highly hazardous chemicals
  - preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals
  - concerning toxic, fire or explosion hazards
- ▷ Establishes a comprehensive management program that integrates technologies, procedures, and management practices
- ▷ Example requirements:
  - *“The employer shall document that equipment complies with recognized and generally accepted good engineering practices”*
  - *“The employer shall perform a pre-startup safety review for new facilities and for modified facilities when the modification is significant enough to require a change in the process safety information”*
  - *“The employer shall issue a hot work permit for hot work operations conducted on or near a covered process”*

# Process Safety Management (USA/OSHA)



OSHA's PSM program is composed of 14 elements

Program started in 1992

PSM does not prescribe how each element is to be implemented

# Process Safety Management

*An alternative graphical representation of the PSM components*

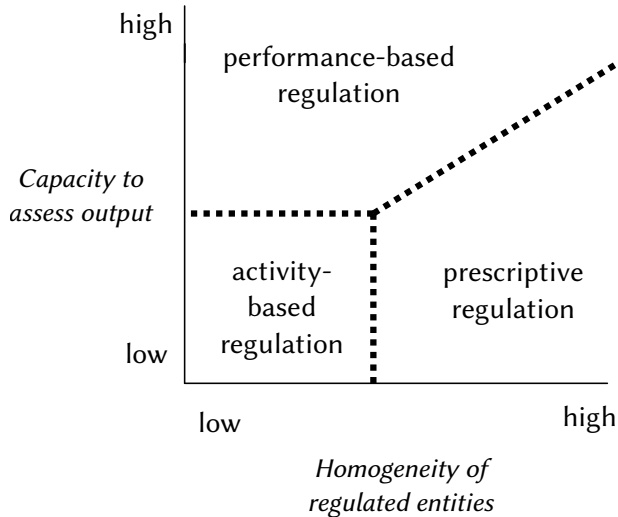




# Risk Management Plan (USA/EPA)

- ▷ US Environmental Protection Agency (EPA)
- ▷ A facility's program should address three areas:
  - Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases
  - Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures
  - Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (*e.g.* the fire department) should an accident occur

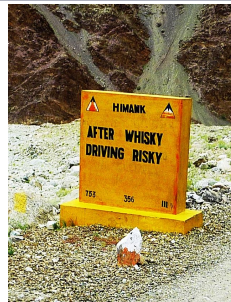
# Choosing the regulation mechanism



Source: *Management-Based Regulation: Prescribing Private Management to Achieve Public Goals*, Coglianese & Lazer, 2003

# Information regulation

- ▷ Also known as *mandatory disclosure regimes*
- ▷ Require firms to disclose information on the risks of their products or environmental impact of their activities
- ▷ Example: warnings of side-effects of medicines
- ▷ Example: the *Toxics Release Inventory* program of US EPA requires firms to provide data on release of toxic substances and waste management activities
  - has been shown to have some impact on stock market value of polluting firms



# Information regulation: examples

- ▷ US OSHA's *Hazard Communication Standard* (1984), implementing “right to know” for workers:
  - provide workers access to information about long-term health risks resulting from workplace exposure to toxic or hazardous substances
  - require manufacturers, importers, and distributors to provide employers with evaluations of all toxic or hazardous materials sold or distributed to those employers
  - information is compiled in the *Material Safety Data Sheet*
  - labelling requirements now being integrated with the GHS CLP

*GHS: Globally Harmonized  
System of Classification  
and Labelling of Chemicals*

# Problems with regulation

- ▷ Regulation is **costly** (to enforce, to respect): almost 10% of GDP in some estimations
- ▷ May involve overlapping regulatory jurisdictions, sometimes conflicting
  - between different bodies of legislation (occupational safety, environmental law...)
  - between local, state and national levels of government
- ▷ Regulators may become “captured” by the industries they regulate
  - Example: Japanese nuclear regulators prior to Fukushima-Daiichi accident
  - Example: US offshore drilling regulator prior to Deepwater Horizon accident
- ▷ Regulatory bodies tend to become **bureaucracies** over time
  - more concerned by interests of their employees than by their mission

# Soft law approaches



# Self-regulation

- ▷ Certain professions such as medicine and law have long been trusted to self regulate
  - assumption: professional pride and interest for maintaining the **reputation of the profession** mean that one's own peers are the strictest regulators
- ▷ Increasingly used in the EU (“better regulation” umbrella)
- ▷ Assumption: the **informational advantage of industry experts** (over government regulators) allows firm-specific (rather than industry-wide) standards to be set, allows cheaper monitoring and enforcement, can be quicker to adapt to technological change
- ▷ Subject to **adverse selection**: if there are no sanctions for firms which participate in the programmes but do not improve their real performance, lower “quality” firms will seek to participate to benefit from the reputational advantages, without being subjected to the costs of change
  - the “free-riding problem”

## Self-regulation: weaknesses

- ▷ Does not necessarily provide assurance of social control over hazards
- ▷ Does not allow *predictability* of what is required, nor equivalent protection for workers in different industries
- ▷ Is an opaque process which does not allow involvement of workers and the public in ensuring firms' accountability in governing risks
- ▷ Industry groups or trade organizations are subjected to short-term pressure from their member organizations which hinders development of high-quality standards



# Liability regimes



# Liability regimes



- ▷ Liability: a legal requirement to compensate another because of an unlawful injury to their person or property
  - common law jurisdictions (UK, USA): tort law
  - civil law countries: civil liability regimes
  
- ▷ Ensures both
  - **deterrence** of risk-creators by providing an incentive to take optimal care to prevent accidents
  - **compensation** of victims when an accident occurs

# Liability regimes

- ▷ **Duty of care** in US common law: a legal obligation imposed on an individual requiring that they adhere to a standard of reasonable care while performing any acts that could foreseeably harm others
  - deciding breach of duty of care: juries decide what an “ordinarily careful person” would have done under the circumstances
  - “**calculus of negligence**”: if  $B < p \times L$ , where  $B$  is the cost of taking precautions,  $p$  is the probability of loss and  $L$  its magnitude, then the duty of care requires the precaution

# Liability regimes and strict liability

- ▷ Strict liability: a person can be held legally responsible for damage caused by acts and omissions *regardless of culpability*
  - discourages reckless behaviour by encouraging to take every possible precaution
  - typically used in situations that are inherently dangerous
- ▷ Reduces legal costs since defendant must only demonstrate causality, not imprudence
- ▷ For product safety, causes manufacturers to internalize costs that they would normally pass on to consumers
- ▷ May over-deter some socially-beneficial risk-taking behaviours where uncertainty is high
  - in particular innovation and new technologies

# Liability regimes and strict liability

- ▷ In situations where risk is generated by the **joint behaviour of two parties**, strict liability can generate incentives for **strategic behavior**
- ▷ Example of reduced precaution caused by strict liability:
  - Consider a farmer who knows that a railway operator will be held strictly liable for all livestock its trains run over
  - The farmer may let more of his livestock wander near the tracks rather than incur the expense of keeping them penned

# Weaknesses of liability regimes

- ▷ **Victim's apathy:** victims are not aware of the harm, or are afraid of long legal process
- ▷ **Insolvency:** if a defendant does not possess sufficient assets to pay for damages caused, he has low incentives to take care
- ▷ **Latency:** when time between exposure to risk and appearance of symptoms is large, deterrence effect is weakened.
  - Example: latency of asbestos exposure claims, up to 40 years
- ▷ **Causal uncertainty:** sometimes difficult to establish causal link between damage and the defendant's actions

## Indirect benefits of liability law

- ▷ **Information disclosure:** tort suits generate information, which can benefit the public
- ▷ **Right to justice** (and the importance that many people attribute to the right to “speak one’s story”)
  - many victims file suit because they want to hold their injurers responsible
- ▷ Torts provide a **substitute to violent retaliation** against wrongful injury
- ▷ Civil liability creates **incentives for regulators** to monitor hazardous establishments
  - regulators may be held liable in case of an accident if their supervision can be demonstrated to have been wanting

# Indirect costs of liability regimes

- ▷ **Inhibiting effect on innovation**, for fear of being exposed to liability for risks that were not anticipated during the design phase
- ▷ Reinforcing **defensive attitudes** during accident investigation
  - people don't want to incriminate themselves or a colleague
  - less understanding is gained from incidents and accidents
- ▷ Reinforcing a **blame culture**: liability produces incentives for a firm to allocate responsibility and blame to the operator at the “sharp end”, rather than identifying contributing factors at the organizational level





# Indirect costs of liability regimes

- ▷ Discouraging manufacturers from improving their products
  - implementing a design change might be misconstrued as an admission of faulty design
  - (backwards logic!)
- ▷ **Hindering sharing of information**, since any uncertainty expressed may later be used to demonstrate liability
- ▷ Causing insurers to be against the admission of fault/error
  - creating more frustrated victims
  - discouraging professionals from learning from mistakes

# Role of insurance



# Insurance



- ▷ Insurance: a **risk-sharing mechanism** which ensures that victims are compensated for the monetary component of a loss
  - allows transfer of financial component of a risk from risk-averse actors to larger, more risk-neutral actors
  
- ▷ Insurance companies can put a financial price on certain facets of industrial risk
  - makes it easier to integrate risk in firms' decision-making
  - differentiated premiums make insurance cheaper if risk reduction measures are implemented
  
- ▷ Insurers provide **safety management expertise**

# Which risks are insurable?

A risk is only insurable if:

- ▷ Insurer can estimate probability & magnitude of losses
- ▷ When accidents occur, easy to decide whether the loss is covered by the policy
- ▷ A sufficiently large number of insurance buyers are exposed to the same risk and are able to afford insurance coverage
  - allows insurer to spread losses over a large population
- ▷ Risk is **not systemic**: few insurance buyers will be exposed simultaneously
  - note: not true for flooding, global warming, pandemics, financial market risks
- ▷ Accidents are **aleatory**: they occur essentially independently of the will of the insured firm, which has taken reasonable measures to prevent them
- ▷ There is an economic agent who seeks to be compensated for the undesired consequences of the industrial activity
  - a problem for some types of environmental damage (biodiversity, protection of landscapes)

# Insurance

- ▷ Very large business: insurers hold  $\approx 11\%$  of all assets worldwide [ACCE]
- ▷ Insurance industry has been the leader in development of codes and standards for fire prevention
  - Example: US National Fire Protection Association (NFPA) publishes many fire safety standards
- ▷ Several industry sectors have an obligation to insure their activities
  - Air carriers have mandatory accident liability insurance coverage
  - Oil tankers required to have insurance sufficient to cover maximum liability for one oil spill
  - Employers often required to be insured for impact of industrial accidents and occupational diseases on their employees

## Mandatory insurance regimes

- ▷ **Nuclear power industry:** international conventions require operators in many countries to hold third party liability insurance
  - provide for strict liability (allowing victims to obtain rapid compensation) which is exclusive to the nuclear operator (who cannot attempt to share liability with suppliers and contractors)
  - however, more than half of nuclear plants in operation or under construction are not covered by an international nuclear liability convention
  - operator's liability is capped at a level which is generally accepted to be far below the real level of damage of a major nuclear accident (governments are insurers of last resort)
- ▷ Air carriers in certain countries have mandatory accident liability insurance coverage
- ▷ Employers often required to take out insurance for the impact of industrial accidents and occupational diseases on their employees

# Weaknesses of insurance

- ▷ The **moral hazard problem**: firms' incentive to take care is reduced by the provision of coverage
  - insurers use *deductibles* to combat moral hazard
- ▷ An **adverse selection process**:
  - firms which are exposed to higher risk levels will tend to buy more insurance coverage than those with low risks
  - insurers may be unable to adapt premiums to risk levels (information asymmetry or “fair access” legislation)
  - firms with low-risk activities may decide it is cheaper to self-insure, leading to a spiral of increasing premiums
- ▷ **Systemic risks** in which a large proportion of an insurer's clients are affected by the same negative event
  - financial downturn, natural disasters, terrorist attacks...

# Economic analysis of regulation and liability law





# Economic justification for safety regulation



- ▷ Regulation reduces freedom: on what basis do we accept it?
- ▷ Economics: classical justification is presence of market failures:
  - externalities
  - incomplete information
  - consumer misperceptions of product quality
  - moral hazards

# Self-interest and the need for safety regulation

- ▷ Suppose I own a house with a fireplace, and 1% chance that a spark from my chimney sets fire to the roof in the next year (10k€ damage)
  - **expected cost** of fire = damages  $\times$  probability = 100€
- ▷ Suppose installation of spark-catching device costs 80€
  - it's in my interest to install device, and also **socially efficient** (social benefits > social costs)
- ▷ Suppose installation of spark-catching device costs 200€
  - bad idea for me and for society (better to purchase fire insurance)
- ▷ Suppose sparks from my chimney can cause fire on my neighbor's roof, with 1% chance per year and 10k€ damage
  - spark-catching device costs 80€
  - my self-interest says to not install the device
  - interests of society are for me to install device (socially efficient precaution)
  - **legal intervention** (regulation or liability) **required for me to make socially efficient decision**

# Negative externalities

- ▷ Externalities: a cost or benefit of an activity which is not transmitted through prices
  - example: environmental impact of CO<sub>2</sub> emissions generated by industrial activity and transport
- ▷ Externalities can lead to **inefficient decisions** (market failures)
  - industrial activity sometimes generates pollution whose cost is primarily borne by people living near the plant, rather than by the company which owns the plant
  - in determining whether running the plant is profitable, the company compares only its costs with the product's selling price, ignoring the negative externality
  - goods are produced despite their total social cost (including the pollution) being greater than their value to society
  - also leads to an inefficiently low level of pollution control: producer may be able to reduce the amount of pollution at a lower cost than the damage caused by the pollution to people in the surroundings, but has no economic incentive to reduce pollution, so may not make the necessary investment

# Negative externalities

- ▷ Externalities provide an **economic justification for regulation**
  - example: diesel vehicles must be equipped with a particle filter
- ▷ Other solution: emission fees (or *Pigouvian taxes*)
  - “polluter pays” principle
  - government charges polluter for damage caused, converting external cost into internal one
  - company will include cost of pollution in selling cost of its product
  - leads to efficient decisions on level of production and on amount of pollution control

# Negative externalities and reciprocal costs

- ▷ Some externalities result from **interaction** between decisions of more than one party
- ▷ Example: impact of airport noise on homeowners under the flight path
  - airports initially built far from urban zones
  - urban growth led to houses in areas exposed to noise
  - responsibility for negative impact is shared between airlines and homeowners
  - it's a “reciprocal cost”
- ▷ Argument of R. Coase: cost of sound control measures should not be borne only by “polluter”
  - otherwise, reducing level of noise would encourage more building in exposed areas, and increased social cost of noise, so higher emission fees
  - polluter would be “punished” for its noise-reduction investment
- ▷ Coase: a social optimum can be reached without government intervention if all parties involved can **negotiate** and organize **compensatory payments**

*Ronald Coase: 1991 Nobel prize in economic sciences*

# Negative externalities and reciprocal costs

- ▷ Consider a steel plant whose activity produces dust which is carried into the garden of a person living nearby, preventing them from growing lettuce
  - negative externality is the combined effect of the plant's activity and the lettuce growing
- ▷ Suppose cost to plant operator of reducing dust levels is greater than value of lettuces to homeowner
  - company can pay exposed homeowner a little more than value of his lettuces
  - all parties better off (market solution is found)
- ▷ Suppose value of lettuces to the homeowner is greater than the cost of pollution control
  - homeowner may pay the company to install the pollution control
  - all parties better off (market solution is found)

# Negative externalities and reciprocal costs

- ▷ Assume the dust affects 100 homeowners
  - if 90 of them agree to contribute to the cost of pollution control and 10 refuse, those who refuse will get a “free ride”, being able to grow their lettuce without having contributed to the pollution reduction
  - each homeowner has an incentive to avoid paying, hoping that his neighbors will bear the cost
- ▷ Economists call this issue *transaction costs*: the cost of reaching and enforcing mutually beneficial private contracts
- ▷ Coase: the presence of negative externalities (which have not been resolved by negotiation between the affected parties) implies that some form of transaction cost prevents private bargaining from eliminating the problem
- ▷ From an economic point of view, transaction costs explain the need for regulation to reach a socially optimal level of prevention

# Incomplete information



- ▷ Suppose that there are 100 second-hand cars for sale in a town: 50 well-maintained cars worth 10 000€ each, and 50 “lemons” worth 2 000€
  - the sellers know which is which, but the buyers don’t
  
- ▷ What will the market price of a second-hand car be?
  - you might think it would be the expected value of a second-hand car (6 000€), but at that price no-one will propose a high quality cars for sale
  - market price will therefore be close to 2 000€
  
- ▷ The market fails to establish a fair price for buyers and sellers
  - “**market for lemons**” phenomenon described by economist G. Akerlof in 1970
  - causes a “race to the bottom” in markets where buyers cannot determine true quality of goods or services



# Incomplete information

- ▷ Some attributes of safety can be thought of as a “quality” of products
  - product safety
  - safety of different transport mechanisms
- ▷ Often difficult for consumers to assess due to lack of technical expertise of available information
- ▷ The “market for lemons” phenomenon means it may be difficult for firms producing safe or environmentally friendly products to sell at a satisfactory price

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## Further reading



- ▷ OECD report *Risk and Regulatory Policy: Improving the Governance of Risk*, 2010
- ▷ OECD report *The Governance of Regulators*, 2014, available from [oecd.org/gov/regulatory-policy/](http://oecd.org/gov/regulatory-policy/)
- ▷ FonCSI report *Risk regulation, liability and insurance: literature review of their influence on safety management*, E. Marsden, 2014, [foncsi.org/en/](http://foncsi.org/en/)

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