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Chapter · June 2006

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Abstract

Monitoring or supervision in the sense of observing behaviour to establish whether the observed party has acted according to the applicable norms or standards of behavior is one of the many possibilities to influence behaviour. In this paper, several legal instruments (tort law, regulation and criminal law) are analysed as instruments to induce parties to behave according to the rules. Those instruments are divided on the basis of when the norm is formulated (before or after the externality is caused), who initiates enforcement of the norm (individual people or the government), how the instrument works (directly or indirectly) and the stage of legal intervention (preclusion, act-based sanctions and harm-based sanctions). It is argued that all instruments have strong and weak points, and that a combination of instruments is necessary. The costs of monitoring and supervision are relevant in determining the optimal mix of enforcement instruments, but are not all-decisive.

1. Introduction

In this paper, I will discuss the topic of monitoring and supervision from an economic point of view. The *Pocket Oxford English Dictionary* defines to monitor as 'observe someone or something in order to record or regulate their activity or progress', and to supervise as 'watch and direct the performance of a task or the work of a person'.[1] For the purpose of this paper, I will use both terms as synonyms, denoting the situation where an actor observes the behaviour of another actor, in order to establish whether the latter has acted according to the applicable norms or standards of behaviour.
Given the focus of this workshop on safety and security in society, I will limit myself to insights from Law and Economics that deal with safety and security. In economic terms, I will link the issue of monitoring to the problem of *internalization of negative externalities* (section 2). Different legal instruments exist with which this internalization can be strived for. I will treat three of such instruments (tort law, regulation and criminal law) and I will compare these instruments on their relative strengths and weaknesses (section 3). Subsequently, I will treat the literature on the topic of 'optimal enforcement' (section 4). It will become clear that society should not aim for a *minimum* level of violations of

[1] C. Soanes, S. Hawker and J. Elliot (Eds.), *Pocket Oxford English Dictionary*, 10th Edition, Oxford: Oxford University Press, 2005.

standards and norms, but an *optimal* level. The benefits of more enforcement have to be weighed against the costs of the measures that are taken to improve enforcement. Monitoring contributes to those costs, so that a decrease in those costs due to e.g. new technology affects the optimal level of enforcement and the optimal mix of instruments to attain this level. In section 5, I will discuss economic literature regarding monitoring and enforcement of environmental policy, because this provides a clear and interesting example of the previously developed insights. Section 6 contains the conclusions.

2. Safety and security in society: internalization of negative externalities

In the economic analysis of law it is assumed that when people are confronted with different possible actions, they choose the one of which they believe that it is best for them, given their information. This is the so-called rational choice theory.[2] Therefore, if someone has to choose between obeying a legal rule or breaking it, he makes an assessment of the consequences of both actions, and chooses the action which yields the best results. The legal rules influence this process.
If, for example, I have to choose between keeping to the speed limit or driving with excessive speed, I weigh my private benefits of speeding (saving time, enjoying the speed, *et cetera*) against the possible costs thereof (more use of gasoline, the possibility of a fine, *et cetera*). The higher the possible fine or the greater the likelihood that I will indeed be fined for speeding, the less attractive speeding becomes. My final decision whether or not to speed therefore is influenced by the likelihood of being sanctioned and the severity of the sanction.

If people undertake activities, they might cause possible negative consequences for others. If I speed, I cause more pollution and create more risks for others than if I keep to the speed limit. If a factory produces, it might create noise, smell and pollution for the people in the vicinity. It might also endanger the employees working with dangerous machines.
If the party who causes these negative consequences for others does not have to pay for them, he creates a *negative externality*. This party does not incorporate *all* costs of the activity in his decision whether to participate in the activity and if yes, to what extent. The private costs of the activity therefore are lower than the social costs. From a social point of view it is desirable that one only engages in an activity if the full costs are lower than the full benefits. If the actor does not have to bear all the costs himself, he engages in the activity too often. Part of the costs is born by others, and these costs lower social welfare. Only by weighing the full costs and benefits of the activity, welfare can be maximized.

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[2] See e.g. J. Elster, 'Introduction', in: J. Elster (ed.), *Rational Choice*, Oxford: Basil Blackwell 1986, p.3; E. Mackaay, 'Schools: general', in: B. Bouckaert & G. De Geest (eds.), *Encyclopedia of Law and Economics. Volume II. Civil Law and Economics*, Cheltenham: Edward Elgar 2000, p. 408.

If the actor who causes the externality is forced to pay for it himself, he will make the correct cost/benefit analysis. He has then *internalized* the negative externality. Different methods of internalization exist. First, in situations where the parties involved can cheaply negotiate with each other (in economic terms, the *transaction costs* are low), they can reach an agreement on the price that the polluter has to pay in order to be allowed to produce, or alternatively on the price that the other party has to pay to the polluter to stop him polluting.[3] In reality, these situations of low transactions costs are scarce, and other instruments are needed.

The use of taxes, the second method to be discussed, is such an alternative. If the factory that pollutes the surroundings has to pay a tax that covers the costs of cleaning up the pollution, the factory has internalized the negative externality. The costs of the tax will be passed on to the consumers, who face a higher price. They will buy less of the product and maybe switch to a cheaper product. The producer therefore gets an incentive to reduce the pollution, if the costs of avoiding (part of) the pollution are lower than the decrease in taxes that it causes. However, it might be very difficult to exactly calculate the optimal tax, because each additional unit of production should be taxed by the additional pollution that this unit has caused.

Third, fines and non-monetary sanctions can in theory lead to internalization of externalities, if they are based on the negative effects of the behaviour on others.

Forth, tort law can lead to internalization. If the damages that the injurer has to pay are based on the losses he has caused to the victim, the injurer is confronted with the negative consequences of his behaviour. He will take care measures that cost less than the losses they avoid, and he also might reduce his activity level.

Finally, negative externalities can be avoided if regulation exactly describes the way in which a certain activity has to be undertaken. If a factory e.g. needs a permit to produce, and if this permit requires the manufacturer to take measures that avoid or reduce pollution, the factory is confronted with the costs of these measures, and therefore it cannot externalize pollution on the people living nearby. The consumers will pay for the measures through the price, and a correct weighing between costs and benefits is made.

3. Relative strengths and weaknesses of tort law, regulation and criminal law

3.1. Introduction

The different instruments for internalizing externalities can be divided on the basis of at least four criteria.[4] First, it can be asked if the norm is formulated *ex*

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[3] R.A. Coase, 'The Problem of Social Cost, (3) *The Journal of Law and Economics* 1960, p. 1-44.

[4] S. Shavell, *Economic Analysis of Accident Law*, Cambridge, Massachusetts: Harvard University Press 1987, p. 278 ff.; S. Shavell, 'The Optimal Structure of Law Enforcement', (36) *The Journal of Law*

ante (so before the externality is caused) or *ex post* (after the externality is caused). Ex ante formulation is often done on a very detailed level, so that the norm exactly describes how the actors should behave. On the opposite, ex post formulation implies that an open norm is used, which is specified ex post on the basis of the circumstances of the actual case at hand.
Second, enforcement of the norm can be initiated by the *government* or by *individual people*. In private law, it is often the individual that starts a case, e.g. by suing the person who has committed a tort or who breached a contract. In criminal law, on the other hand, it is often the government (through the public prosecutor) who initiates the case.
Third, the way in which the externality is combated can be *direct* or *indirect*. If an indirect method is used, the actor receives incentives to change his behaviour, e.g. by the prospect of having to pay a fine if he acts wrongly or damages if he causes losses. Also imprisonment, taxes and subsidies are indirect ways to influence behaviour. Direct methods, on the other hand, exactly describe the way in which the actor has to act, and also enforce this. For example, the government can issue detailed norms for maximum emission of pollution, and close down a factory that exceeds the limits. Also an injunction directly combats the externality.
The fourth distinction partially overlaps the distinctions ex ante/ex post and direct/indirect. Legal intervention can take place at three stages. When it takes place at the earliest possible stage, the harmful act is *precluded*. This is ex ante intervention in a direct manner, e.g. a police officer that stops an actor from committing a crime. Preclusion occurs through the use of force or physical barriers. Legal intervention may also result after the act has been committed, but before harm results or irrespective of whether it does. E.g. a speeding ticket is issued on the basis of speeding, irrespective of whether the speeding motorist caused losses. Such *act-based sanctions* are ex ante, indirect methods. Finally, legal intervention might be triggered by causing harm. E.g. tort damages can only be sued for after losses already have occurred. These *harm-based sanctions* are ex post and indirect. The difference between act-based and harm-based instruments can also be characterized as *input monitoring* versus *output monitoring*.[5]
Tort law, regulation and criminal law can be categorized on the basis of these criteria. It is important to realize that the first three criteria are not binary in character, but rather form three continuums. For example, tort law is *mostly* ex post (by applying the open due care norm, which is specified after an accident), but rules of strict liability are formulated ex ante. When discussing the relative strengths and weaknesses of the different instruments, this characteristic of continuums should be kept in mind.

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and Economics 1993, p. 257 ff; S. Shavell, *Foundations of Law and Economics*, Cambridge, Massachusetts: The Belknap Press of Harvard University Press 2004, p. 572 ff.

5 D. Wittman, 'Prior Regulation versus Post Liability: The Choice Between Input and Output Monitoring', (6) *The Journal of Legal Studies* 1977, p. 193.

As explained above, internalization of externalities increases welfare, because the actors make a better weighing between the costs and benefits of their activities. This avoids a too high activity level and a too low care level, which would cause negative consequences for third parties. However, the instruments that can achieve internalization might be more or less costly themselves. These costs of internalization should be taken into account when deciding which instrument(s) to use. The costs also influence the optimal level of enforcement: it is socially desirable to allow a certain degree of norm breaking behaviour (even though this causes negative externalities), because the costs of avoiding these violations are higher than the benefits of additional deterrence. Furthermore, information on the behaviour of the actors and the consequences thereof is needed to internalize externalities. It is more or less costly to acquire and process the necessary information, and these costs also have to be taken into account when choosing the internalization instrument(s) and when determining the desired rate of compliance.

3.2. Tort law

3.2.1. The criteria applied

Tort cases are primarily initiated by the victims, so that the initiative lies with individual people instead of with the government. The most important tort is negligence, hence the violation of an unwritten, open norm of due care. Therefore, tort law is primarily ex post. However, in situations of strict liability, or when the tort consists of violating a statutory duty, ex ante features are dominant. In most cases, plaintiffs sue for damages, so that tort law primarily is an indirect way of fighting externalities. In the more exceptional cases where plaintiffs ask an injunction, it is direct. Tort law mostly uses harm-based sanctions (damages), although an injunction is an instrument that precludes the damaging act.

3.2.2. The economics of tort law in a nutshell

Law and economics scholars argue that tort law can lead to the internalization of externalities, because the tortfeasor is confronted with the negative consequences of his behaviour for others. This result can be achieved through negligence and strict liability.
Under negligence, an injurer is only liable for the losses if he did not take enough care. In formulating the level of due care, the court should compare the costs and benefits of care measures that the injurer could have taken. If the costs of an additional care measure are lower than the benefits thereof (the reduction in the accident probability and/or the reduction in the losses if an accident occurs), yet the injurer did not take this measure, he should be deemed negligent.[6]

[6] This is the so-called *Hand formula*, named after judge Learned Hand who applied this line of reasoning in the case *United States v. Carroll Towing Co.*(159F.2d 169 (2d Cir. 1947)). He argued that an

This induces the injurer to take the care measures that cost less than they yield, so that social welfare is maximized. Under strict liability, the injurer is always liable, irrespective of his care level. He will therefore take all the care measures that he himself thinks are cost justified.
A major difference between negligence and strict liability therefore is, that under negligence the court decides the due care level and the injurer adapts his behaviour to it, while under strict liability the injurer chooses his care level himself. The quality and costs of information for courts and injurers therefore form an important aspect in the choice between the two rules.
In addition, under strict liability the injurer will engage less often in the activity, because he has to bear the full costs thereof. Hence, he will only engage in the activity if the utility that this yields exceeds the full costs of the activity. This leads to an optimal activity level, because the costs and benefits are weighed properly. Under negligence, however, the injurer only has to bear the costs of due care, so that he already engages in the activity as soon as it yields him more utility than those care costs. The activity level under negligence will therefore be too high.

3.2.3. Relative strengths of tort law

First, tort law predominantly applies open norms, which are easy to formulate. The costs of norm formulation therefore are low. The disadvantage of open norms (they do not give clear guidelines for behaviour) will be limited, because over time, legal verdicts specify the open norm for different types of situations.
Second, only in cases where harm occurred and a suit is filed, the open norm has to be specified. Given that many cases are settled outside of court, or are dealt with administratively by insurance companies, the system costs will be relatively low. The system costs are presumably lower under strict liability than under negligence, because the court does not have to investigate whether the injurer was at fault. Each case is therefore less complicated under strict liability. The possible result that more cases might be filed is more than offset by the fact that more cases will be settled, due to the higher degree of predictability of the courts' decision.
Furthermore, courts are less sensitive to the influence of interest groups than legislators, and the open norms in tort law limit the possible benefits of influencing decisions anyway.
Fourth, tort law utilizes the information that is available to the parties involved. In typical tort cases, the victim knows who injured him, so the costs of identifying the injurer are relatively low.[7] In the choice between strict liability and negligence, information is relevant as well. Under negligence, the court has to

injurer was negligent if the burden of adequate precautions (B) was lower than the product of the probability of an accident (p) and the gravity of the resulting injury if an accident occurs, so if $B < pL$.

7 W.M. Landes and R.A. Posner, 'The Private Enforcement of Law', (4) *The Journal of Legal Studies* 1975, p. 31; Shavell 1993, op.cit. (note 4), p. 267.

weigh the costs and benefits of care measures in formulating the due care level. Under strict liability, the injurer himself decides which level of care to take. If the injurer has better information about the costs and benefits of taking care (e.g. because he is a specialized manufacturer of complicated products), strict liability is preferable, because it makes use of the superior information of the injurer.

3.2.4. Relative weaknesses of tort law

The indirect approach, using tort damages as instrument, requires that victims indeed bring suit and that all injurers who committed a tort indeed pay damages. There are many factors that lead to a too low 'probability of conviction'. Victims might decide not to bring suit because the costs are higher than the expected benefits (which is especially problematic with losses that are spread over a large group of people, so that each individual victim only bears a small loss, but the total loss can be substantial),[8] or they might face problems in proving fault or causation. In principle, increasing the amount that the injurer has to pay, so that the expected damages (i.e. the probability of having to pay damages, multiplied by the magnitude of these damages) again equal the expected losses caused by the injurer, can offset this too low probability of conviction. However, many countries do not accept such punitive damages, and high levels of damages might lead to the *judgment proof problem*.

An injurer is said to be judgment proof, if he does not have enough assets to pay the damages. Tort law then cannot provide correct behavioural incentives, because an injurer will not be deterred by damages that he cannot pay anyway. Vicarious liability might solve this problem. This implies that someone else is held liable instead of the actual tortfeasor. From an economic point of view, vicarious liability makes sense if the liable party has more assets than the actual tortfeasor (so that the judgment proof problem is avoided) and if the liable party has other instruments to provide care incentives for the tortfeasor. For example, an employer is often vicariously liable for the torts committed by his employees. The employer presumably has more assets, and he can provide care incentives through the labour relation (granting or withholding promotion, wage raises, terminating the contract, *et cetera*). Of course, vicarious liability creates monitoring costs, because the principal has to supervise the agent in order to be able to determine his care level.[9]

Finally, the tendency in tort law to protect the victim ex post inefficiently increases the standard of care for the injurer, while simultaneously decreasing the standard of care for the victim himself.

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[8] See e.g. Landes and Posner 1975, ibid., p. 33.

[9] R. H. Kraakman, 'Vicarious and Corporate Civil Liability', in: B. Bouckaert & G. De Geest (eds.), *Encyclopedia of Law and Economics. Volume II. Civil Law and Economics*, Cheltenham: Edward Elgar 2000, p. 670, 671.

3.3. Regulation

3.3.1. The criteria applied

Regulation makes use of detailed rules that describe the way in which actors should behave. It is therefore an ex ante and direct method of dealing with externalities. The government is the dominant actor, in issuing the regulation, in monitoring whether actors obey it and in enforcing the regulation by the use of force and/or fines. The timing of legal intervention can be at the earliest stage (e.g. not allowing a factory to produce before it adheres to the requirements posed by regulation), but regulation also uses act-based sanctions (e.g. imposing a fine if a building does not have proper fire exits). If costs of monitoring compliance are high, harm-based sanction can be chosen, because the occurrence of harm can provide information on possible wrongful behaviour.

3.3.2. The economics of regulation in a nutshell

For the purpose of this paper, the notion that the regulator can provide and enforce norms and standards for behaviour to fight negative externalities suffices.[10] If the regulator defines the norms and standards on the basis of a weighing of costs and benefits of possible care measures, regulation can provide actors with incentives to behave optimally. Obviously, in order to induce actors to obey the norms or standards, they have to be enforced, which causes enforcement costs. Monitoring and supervision, as well as execution of sanctions are sources of such costs. The complications that arise if the regulator does not possess adequate information, or that pressure groups try to influence the regulator so that regulation does not primarily serve the general interest but the private interest of the pressure group, are treated in the subsequent sections.

3.3.3. Relative strengths of regulation

If the regulator has better information than courts or the parties involved, it is best that he formulates a clear norm on desirable behaviour. In formulating this norm, the regulator weighs the costs and benefits of possible care measures. Given his superior information, this will lead to a better rule than under negligence (where the courts formulate the rule) or strict liability (where the injurer himself decides which measures to take).[11] An additional advantage is, that regulation can be applied to *all* actors, so that regulation can benefit from economies of scale. The regulator e.g. can analyze the possible dangers of work-

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[10] See e.g. J. den Hertogh, 'General Theories of Regulation', in: B. Bouckaert & G. De Geest (eds.), *Encyclopedia of Law and Economics. Volume III. The Regulation of Contracts*, Cheltenham: Edward Elgar 2000, p.229; R.G. Noll, 'Economic Perspectives on the Politics of Regulation', in: R. Schmalensee and R.D. Willig (eds.), *Handbook of Industrial Organization. Volume II*, Amsterdam: North Holland 1989, p. 1256.

[11] S. Shavell, 'Liability for Harm Versus Regulation of Safety', (13) *The Journal of Legal Studies* 1984, p. 359 ff.

ing with toxic chemicals, heavy equipment *et cetera*, and issue regulation on working conditions that affects all firms using these materials.
Furthermore, the ex ante character of regulation solves the judgment proof problem, by either using instruments that preclude the act from being carried out altogether, or by using act-based sanctions instead of harm-based sanctions. Act-based fines can be (much) lower than harm-based fines/damages, because they can be discounted by the probability that the act leads to harm.[12]
Finally, because the government is the predominant actor, the problem that potential victims might decide not to bring suit because their private costs are too high, is solved.

3.3.4. Relative weaknesses of regulation

Public Choice theory argues that the regulator is susceptible to the influence of interest groups. Therefore, regulation need not be the result of a correct weighing of costs and benefits of possible measures to internalize negative externalities. It might, on the other hand, be the result of a successful lobby, thereby promoting the interests of specific pressure groups instead of increasing social welfare. In order to issue regulation, the government often has to rely to a certain extent on information issued exactly by the parties that are being regulated. These parties will have an incentive to provide information in such a manner that it furthers their goals. This problem is known as *capture*.[13]
Regulation resembles fault liability in the sense that an injurer that keeps to the norms might not be subjected to sanctions. As explained in section 3.2.2, this leads to a too high activity level, compared to strict liability.
An important drawback of regulation in the context of this paper, are the high system costs. Issuing detailed regulation is more costly than issuing open norms. This problem is worsened because regulation can be issued by different agencies, so that problems of consistency occur (e.g. the doors of a day-care centre have to be locked due to regulation concerning the safety of children (it prevents them from running onto the street), but they have to be unlocked due to fire regulation).
More importantly, because regulation is ex ante, the costs of monitoring can be very high. After all, monitoring occurs before it is clear if externalities exist. If administering speed controls, *all* motorists are monitored, not only those who are speeding. And if restaurants are (randomly) checked for their hygiene, also restaurants that obey all regulations are visited. Ex post measures do not have these high monitoring costs, because the victim of an accident might have enough incentives to respond to the externality after it has occurred, and in any case the measure is only applied in the exceptions where harm was caused. The costs of monitoring can theoretically be lowered by decreasing the level of monitoring (and thereby the probability of being caught), while simultaneously

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[12] Shavell 1993, op.cit. (note 4), p. 262.
[13] M.E. Levine, 'Regulatory Capture', in: P. Newman (ed.), *The New Palgrave Dictionary of Economics and the Law*: Volume 3, London: Macmillan 1998, p. 267-271.

raising the fine. The expected sanction remains the same, yet the costs of enforcement decrease.[14] However, the increased fine in itself could again cause the problem of judgment proof.

3.4. Criminal law

3.4.1.. The criteria applied

In criminal law, the government is the predominant actor in issuing the rules and in enforcing them, although in some cases the public prosecutor can only try a case after a complaint of the victim. The rules are formulated ex ante, but enforcement is mostly ex post (preventive detention is an exception to this). Criminal law can be applied before and after the criminal act, and also after harm has occurred. The applicable sanctions (fines or imprisonment) are indirect methods to internalize externalities, but if a person is detained, this directly prevents him from committing other criminal acts.

3.4.2. The economics of criminal law in a nutshell

In his seminal article from 1968, Becker gave an economic analysis of crime and punishment. His main purpose was to determine how many resources and how much punishment should be used to enforce different kinds of legislation. Several factors are relevant in answering this question.
The first factor is the harm caused by norm violations, which increases with the number of offences.[15] Of course, the offenders yield gains by their offences, and these gains also increase with the number of offences. Becker defines the net cost or damage to society as the difference between harm and gain.[16] These net costs probably increase if the number of offences increases.
The second factor is the cost of apprehension and conviction. The more is spent on police, courts, *et cetera*, the easier it is to discover offences and convict offenders. The lower these costs, e.g. due to technologies such as fingerprinting, wiretapping, computer control and lie detecting, the cheaper a given level of apprehension and conviction would be.
The third factor, the supply of offences, depends on the probability of apprehension and conviction and the severity of the sanction. It appears that an increase

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[14] See e.g. A.M. Polinsky and S. Shavell, 'Public Enforcement of Law', in: B. Bouckaert and G. De Geest (eds.), *Encyclopedia of Law and Economics. Volume V. The Economics of Crime and Litigation*, Cheltenham: Edward Elgar 2000, p. 312.

[15] G.S. Becker, 'Crime and Punishment: An Economic Approach', (76) *Journal of Political Economy* 1968, p. 173.

[16] Shavell does not incorporate the gains that injurers get from committing intentional norm violations in the social welfare function. He regards their utility as 'social illicit'. Friedman does not agree with this method, because by labeling certain activities as social undesirable, even if they yield more gains to the injurer than they cause losses for the victim, the conclusion that these acts are undesirable is presumed instead of proven. See Shavell 1987, op.cit. (note 4), p. 147 and D.D. Friedman, *Law's Order. What Economics Has to Do with Law and Why it Matters*, Princeton, New Jersey: Princeton University Press 2000, p. 229 ff.

in the probability has a greater effect than an increase in the punishment.[17] Also other factors, such as income and law-abidingness due to education, are relevant. The last factor concerns punishments, which differ in the costs they impose on the offender. They also affect other members of society. The total costs of punishment are the cost to offenders plus the cost or minus the gains to others. Fines produce a gain that equals the cost to the offender, aside from collection costs. Imprisonment, on the other hand, also causes costs to others, e.g. the need for guards, buildings, *et cetera*. Imprisonment is therefore more expensive than the use of fines.
According to Becker, the criminal justice system should aim to minimize the total social costs. This implies that the severity of a sanction should depend on the harm caused, but also on the probability of apprehension and conviction. Furthermore, imprisonment should be replaced by fines whenever possible, due to the lower social costs. Finally, one should not aim for maximum deterrence, but optimal deterrence. The enforcement costs are one of the factors determining the optimal level of enforcement.[18]

3.4.3. Relative strengths of criminal law

Criminal law can make use of non-monetary sanctions such as imprisonment. These methods can offer a solution to the judgment proof problem. Even if an actor has limited assets so that the financial threat of fines or damages does not provide adequate behavioural incentives, the possibility of being detained might provide enough incentives after all.
Criminal sanctions are regarded as relatively heavy, due to a negative reputation effect and the consequences they might have for employment or personal relationships. This offsets the low probability of conviction, because the expected sanction can still be high.
The negative association that people generally have with criminal activities in itself can already prevent them from engaging in such activities, so that these norms do not cause high enforcement costs. However, this requires that criminal rules remain exceptional. The more types of undesired behaviour are treated as crimes, the less this 'self-enforcement' will occur.

3.4.4. Relative weaknesses of criminal law

Criminal law is an expensive instrument to control externalities. The punitive element essentially lowers social welfare because it imposes costs on the convicted offender without offering offsetting gains elsewhere. This problem is larger with imprisonment than with fines, because a fine is a transfer of money, while the imprisonment creates additional harm.
This also implies that the consequences of a wrongful conviction are much greater than the consequences of a wrongful acquittal, so that the legal proce-

[17] Becker 1968, op.cit. (note 15), p. 176.
[18] Becker 1968, op.cit. (note 15), p. 207 ff.

dure needs many safeguards against wrongful convictions. This increases the system costs and reduces the probability of conviction. It also might cause high monitoring costs, because it is only worthwhile to start the costly criminal procedure if there is enough evidence to sustain the charge.
Furthermore, imprisonment is a costly sanction, when compared to fines and damages, not only because of the stigmatizing character, but also because of the high costs of guards, buildings *et cetera*.
Finally, the officials in the whole process have to be monitored themselves, to avoid abuse of power *et cetera*. This introduces a new type of monitoring costs, because not only actors who might not act according to the norm have to be monitored, but also the officials in the criminal procedure.

3.5. Conclusion

Tort law, regulation and criminal law all have their strengths and weaknesses. Depending on the circumstances, one instrument might work better than the other, and in economic theory it is well established that a combination of instruments is needed to optimally internalize negative externalities.[19] If e.g. the legislator has the best information on the costs and benefits of certain types of behaviour, regulation is preferred over tort law. On the other hand, negligence is superior if courts have the best information, and strict liability if the injurer is the most informed party. Regulation might offer minimum safety rules, thereby profiting from economies of scale, but under specific circumstances, tort law might induce actors to take additional care measures. The use of ex post monetary sanctions is problematic if the injurer is judgment proof, so that ex ante regulation or ex post non-monetary sanctions are more appealing in cases where optimal tort damages would be so high that they indeed cause judgment proof problems. Criminal law has high system costs due to e.g. the penalizing character, but the non-monetary sanctions might be necessary to solve the problem that tort law does not provide adequate incentives in cases of widely spread losses.
Generally speaking, Law and Economics has a preference for tort law. Private parties know their own preferences best and they can act accordingly. They often possess adequate information on costs and benefits of care measures and on the identity of the injurer. The system costs of tort law are relatively low, due to the ex post, harm-based sanctions and the open norm character. In cases where tort law does not work properly, due to informational problems, judgment proof injurers or too low probabilities of conviction, regulation and criminal law become more important. Due to the high system costs, criminal law should serve as an *ultimum remedium*.
The list of relevant factors in deciding the optimal mix of the different instruments is long, and many interrelations between them exist. The costs of monitoring are one of those factors. It is therefore important to realize that one should not solely focus on these costs, but has to embed them in the broader framework.

[19] See e.g. Shavell 1984, op.cit. (note 11), p. 365.

The costs should not be neglected either, because changes in the costs of monitoring, e.g. due to technological changes, influence the optimal mix of instruments. In the next paragraph, I will therefore analyze the optimal mix of instruments in general, and I will pay specific attention to the role of the costs of monitoring and supervision.

4. Optimal enforcement and the influence of monitoring and supervision

4.1. The choice between preclusion, act-based and harm-based sanctions

Several factors influence the choice between the different instruments to control risk. If the possible sanctions are only small, they might not be able to deter undesirable behaviour, so that preclusion through force or physical measures is the only possible alternative. As the magnitude of potential sanctions increases, act-based sanctions become available as well, and if the magnitude becomes sufficiently high, harm-based sanctions can be used. Shavell gives a clear numerical example regarding this relationship.[20] Suppose that a person obtains a benefit of 50 from an undesirable act that causes high losses with a probability of 20%. Also suppose that the highest possible sanction is 100, that there is a 30% chance that an act-based sanction will be applied and that there is a 30% chance that a harm-based sanction will be applied if harm occurs. Neither type of sanction can deter this person, because the expected act-based sanction is 0.3*100 = 30 and the expected harm-based sanction is 0.2*0.3*100 = 6, while the private benefits where 50. The only way to avoid the undesirable act therefore is preclusion by force or physical measures. The sanction has to be at least 166.67 for act-based sanctions to work (because 0.3*166.67 = 50) and 833.33 for harm-based sanctions to work (because 0.2*0.3*833,33 = 50). The possible magnitude of sanctions is determined by the wealth of the party involved, or with imprisonment by his remaining life. Also, notions of fairness can limit sanctions (e.g. life imprisonment for shoplifting would be considered as being unfair), and in the economic analysis of criminal law it is well established that the magnitude of the sanction should rise with the size of the harm (*marginal deterrence*). These limits on the magnitude of the sanction can lead to the necessity of increasing the probability of sanctioning, thereby probably increasing the costs of monitoring, to offset the limited size of the sanction.[21]

Second, the probability of sanctioning is relevant. If it is difficult to preclude by force or physical measures, act-based or harm-based sanctions become more appealing. If monitoring of behaviour is difficult, preclusion or harm-based sanctions become more attractive. If it is difficult to establish a causal relation between certain harm and the possible acts that have caused them, preclusion or act-based sanctions are better. It should be noted that improvements in monitor-

[20] Shavell 1993, op.cit. (note 4), p. 261 ff.

[21] See e.g. A.M. Polinsky and S. Shavell, 'The Fairness of Sanctions: Some Implications for Optimal Enforcement Policy', (2) *American Law and Economics Review* 2000, p. 232.

ing techniques can increase the probability of sanctioning, but this might induce actors to spend resources in order to evade being detected. For example, radar controls have increased the probability of being caught when speeding, but devices such as a radar detector or see-through covers for license plates that cause a picture of the license plate to be illegible could offset this increase (just as the mere destruction of camera poles would). Also, devices that scramble the signal of mobile phones or computer data reduce the effectiveness of monitoring these forms of communication. This can lead to a costly alternation of measures and countermeasures, which lowers social welfare.

Third, the level of information is important. If parties have good information on the dangerousness of their behaviour, harm-based sanctions can provide correct incentives. If they lack this information but they know that certain behaviour is not allowed, act-based sanctions could deter adequately. If the actor is unaware of the dangers of his actions, he might not realize that his act is forbidden, so that neither harm-based nor act-based sanctions work. Preclusion then is the only option. This of course assumes that the social authority has better information regarding the true dangers.

Also the enforcement costs are relevant. If it is relatively cheap to deter people by using physical measures (e.g. fencing an area in which they otherwise might dump toxic waste), sanctions become less attractive. However, if preclusion requires the use of officials who constantly have to monitor the behaviour of actors, it might become too expensive so that sanctions have to be used. Harm-based sanctions then have an advantage over act-based sanctions, because they are applied less often. In some circumstances it may be easier to impose act-based sanctions (e.g. determining whether oil tanks of ships are properly maintained might be easier than detecting whether a ship has leaked oil into the ocean),[22] in other circumstances harm-based sanctions could be easier (e.g. determining whether a driver who caused an accident made a wrong turn as opposed to constantly observing all drivers on their turns).

Finally, determining the expected harm of an act might be much more difficult than ascertaining the actual harm if an accident has occurred.

Technological developments can change the relative attractiveness of preclusion, act-based sanctions and harm-based sanctions. For example, if speeding of motorists could only be detected by police officers that subsequently would have to chase the speeding motorist to fine him, act-based sanctions would be very expensive. The use of radar and photo cameras decreases these costs substantially, so that act-based sanctions become feasible. Recent developments in so-called *Intelligent Speed Adaptation* (ISA) might even preclude speeding altogether. With an ISA system, an onboard computer can, by the use of GPS, determine the position of the vehicle. The computer checks whether the local speed limits are exceeded. If they are exceeded, the driver is warned by a signal, or the device even reduces the speed of the vehicle automatically. Detection of shoplifting through the use of electromagnetic gates instead of personnel that

[22] Polinsky and Shavell 2000, ibid., p. 315, 316.

constantly scans the shop is another example. Also the way in which drunk driving is combated might change, e.g. if *alcohol locks* become cheaper to manufacture. This way, a drunk driver *cannot* drive his car and this act is therefore physically precluded.[23] This might be better than act-based sanctions (a fine and/or confiscation of the driver's license) or harm-based sanctions (civil or criminal liability after an accident is caused due to drunk driving). At present, the alcohol lock is sometimes installed to avoid repeat offences. The higher probability of drunk driving of someone who was already convicted for this offence, justifies the still substantial costs of applying the technique. The mere probability of act-based and harm-based sanctions are too low for repeat offenders, compared to the externalities they are likely to cause.[24]

Wittman analyzes the complicated relationship between act-based and harm-based sanctions. In essence, the monitoring actor has four methods of control available: (1) the probability of detecting and sanctioning the act, (2) the sanction when the act is detected, (3) the probability of detecting and sanctioning harm and (4) the sanction when harm is detected. If a change in technology decreases the costs of detecting an act (e.g. the introduction of radar to monitor speed), act-based monitoring becomes more attractive compared to harm-based monitoring. The severity of the punishment will decrease, because the higher rate of detection leads to more convictions, thereby increasing the social costs of

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[23] It is possible that a passenger takes the breath test, so that a drunken person can still drive. To decrease this problem, the test has to be repeated with random intervals (while driving) and taking the test for someone else is considered as a criminal offence.

[24] A recent Dutch situation provides an example regarding the relation between available information, technical measures, public or private initiative and the probability of 'being caught'. One of the many tasks of the General Inspection Service ('Algemene Inspectiedienst AID') is to monitor cattle markets on cruelty to cattle. In 2005 the AID received information from vets and cattle traders that in some instances animals were mistreated, and therefore additional supervision is executed. On August 24, 2006, the foundation Animalrights Netherlands ('Dierenrecht Nederland') has published photographs and videos which were made with the use of hidden cameras, which show that mistreatment of cattle still occurs. The foundation has pressed charges against the persons involved. The Dutch Minister of Agriculture has responded that supervision by the AID has to be improved and increased.
In terms of this paper, vets and traders possessed private information regarding cruelty to animals, and after they conveyed this information to the AID, supervision was increased. Obviously, the idea behind increased supervision is to increase the probability of getting caught and hence the expected sanction. Apparently, the increased supervision did not solve the problem. This could very well be explained by the high costs of supervision (due to the costs of monitoring one should aim for optimal rather than maximal deterrence) and the fact that the AID has to supervise other activities as well. Private entities such as the foundation Animalrights are able to provide additional information, e.g. by using instruments which public bodies are not allowed to and by the fact that they can operate incognito (cattle traders who see the AID inspector will probably behave according to the rules, just as many motorists will reduce their speed when they see a police car). As a result of the new information, public monitoring might increase.
Obviously, the increase in public monitoring is not necessarily desirable. The AID might have to reduce supervision in other areas, which might lead to more problems in those areas. Cruelty to animals is an area where the public opinion is an important factor. From the perspective of Public Choice theory it is therefore not surprising (especially if one considers that general elections were scheduled to take place three months later!) that on the same day that Animalrights Netherlands published the evidence, members of Parliament have confronted the government with this issue, and the Minister of Agriculture has already promised increased supervision. It is noteworthy that in the general elections, the Party for the Animals ('Partij voor de Dieren') has won two seats in Parliament.

sanctioning. The expected act-based sanction increases, because the increase in probability outweighs the decrease in magnitude of the sanction.[25]

4.2. The role of information

In section 3 it is already discussed that in setting the standard for behaviour, regulation makes use of the information of the government, negligence of the information of courts and strict liability of the information of the injurer.
It is also mentioned that tort law uses the information that the victim has regarding the identity of the injurer, because it requires the victim to bring suit against (a) specific defendant(s). Also the desire not to be harmed (again) and to see the injurer suffer sanctions can induce the victim to use his information to identify the injurer.
In situations where the victim does not possess information on the identity of the injurer, public enforcement activity may be necessary. Private parties might not have enough incentives to identify the injurer, e.g. because they bear the full costs of identification but only expect little benefits. The private benefits of finding the injurer can therefore be lower than the social benefits, which consist of the possibility to confront the injurer with the negative externalities he has created. It can also be the case that it is socially desirable that information systems or other enforcement technologies are developed, but that it is not worthwhile for individuals to do so. Fingerprint records or DNA databases, shared information systems, satellite surveillance for environmental pollution *et cetera* are so-called *natural monopolies*. This means that they can be most cheaply produced on the largest possible scale, because they have huge fixed costs and low marginal costs. New information sharing technologies, e.g. through the Internet, can change this character, so that smaller units of information gathering might become optimal, and private initiatives again become feasible.
From an economic point of view it is - all else being equal - desirable to use the instrument for internalizing externalities that retrieves the necessary information at lowest cost. Monitoring is a relatively expensive method to collect information, especially compared to tort law. After all, under a regime of tort law the victim has an incentive to sue the injurer, so that the behaviour of potential injurers need not be constantly monitored to discover harmful behaviour. Strict liability, moreover, induces the injurer to utilize his information in determining which care measures to take, because he always bears both the costs of those care measures and the expected losses. This reduces the need to monitor the injurer for possible norm violating behaviour, as well as the need for the courts (negligence) or regulator (regulation) to attain the necessary information. Obviously, the relative weaknesses of tort law limit its information cost saving potential, so that regulation and/or criminal law might be necessary as well.

[25] Wittman 1977, op.cit. (note 5), p. 196.

4.3. The framework applied to the legal instruments[26]

In tort law, harm-based monetary sanctions are applied. Direct prevention would be impossible in many of the types of accidents that tort law seeks to deter. It is e.g. not possible to monitor many of the measures that motorists can take to avoid accidents, such as paying adequate attention to traffic instead of changing a CD, starting the journey on time so that time pressure is avoided, not driving when one is tired, *et cetera*. Act-based sanctions are also too costly, because many acts can cause losses. Monitoring all these types of behaviour and sanctioning them is very costly, while in most cases no harm occurs. Harm-based sanctions are therefore the only feasible instrument to provide incentives for better behaviour. The mere fact that harm actually occurred can provide information on the dangerousness of the activity, although it is important to keep in mind that also an injurer that takes due care can cause losses. Monetary sanctions are often enough to provide the necessary incentives. In cases where the injurer deliberately reduces the chance that he will be identified (e.g. by leaving the scene of the accident that he has caused), non-monetary sanctions from criminal law might be used to provide adequate incentives after all.

Regulation comes into play if the regulator has superior information, or if the harm-based sanctions of tort law do not adequately deter, e.g. due to the judgment proof problem or a too low probability of being held liable. Shavell provides the examples of regulation to avoid a fire in a restaurant (large expected losses), health-related losses (difficult to establish causation, thereby lowering the probability of being held liable) and environmental losses (problems with causation and possible widely dispersed losses, which both lead to a too low probability of being held liable).[27] Under these circumstances it is better to prevent the act in the first place. When this is impossible or too costly, e.g. due to costs of monitoring, act-based sanctions are used. Obviously, these also require monitoring in order to detect the acts. If the probability of detection, combined with the possible fine, is not high enough to deter, criminal law might be needed.

Criminals often try to avoid being detected and being caught. This reduces the probability that act-based or harm-based sanctions can be applied, so that the magnitude of the sanction has to be increased to offset this. This, together with the often limited assets of the criminal and the gains he expected to yield, explains the use of non-monetary sanctions. It also clarifies why criminal law sometimes tries to prevent the crime in the first place, and why attempts that do not succeed are punished nonetheless. Furthermore, people that committed crimes have shown that they were not deterred by the expected sanctions (‘*gen-*

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[26] Shavell 1993, op.cit. (note 4), p. 271 ff.

[27] Shavell 1993, op.cit. (note 4), p. 279. Also see M. Boyer and D. Porrini, ‘The Choice of Instruments for Environmental Policy: Liability or Regulation?’, in: R.O. Zerbe and T. Swanson (eds.), *An Introduction to the Law and Economics of Environmental Policy: Issues in Institutional Design*, Volume 20, Elsevier Science Ltd., p. 246.

eral deterrence'), and imprisonment might be the only way to prevent them from committing further crimes ('*specific deterrence*').

Polinksy and Shavell distinguish between fixed and variable enforcement costs.[28] The fixed enforcement costs are independent of the number of violations of a standard and are incurred to reach or maintain a certain probability of detection. The variable enforcement costs on the other hand depend on the number of violations and are made in order to actually fine the violator. The optimal fine equals the harm, corrected for the probability of detection, as well as the variable enforcement costs. This implies that the optimal fine will increase if variable enforcement costs rise and/or if the probability of detection decreases due to higher fixed enforcement costs. The optimal probability of detection decreases if fixed and/or variable enforcement costs increase. It simply becomes too expensive to detect violations and/or to impose the sanction on violators.
Monitoring concerns fixed enforcement costs. Therefore, if technological changes decrease these costs, the optimal probability of detection increases, and the optimal magnitude of the fine decreases. These changes increase the attractiveness of regulation *vis-à-vis* tort law and criminal law.

4.4. Liability of monitoring agencies

An interesting and actual topic where several of the abovementioned insights are relevant is liability for monitoring agencies.[29] In many fields of public safety, governments make use of monitoring agencies that have to check whether actors in the relevant field behave according to the applicable regulation. Examples can be found regarding the quality and safety of food, medicines, consumer goods, safety of the workplace, *et cetera*. These agencies should contribute to public safety by responding to observed norm violating behaviour through e.g. imposing fines, withdrawing permits or even forcefully correcting dangerous situations.
If an actor violates the rules and thereby causes losses, the monitoring agency cannot be automatically held liable for these losses. Only if the supervision was inadequate or if the agency did not respond to a situation where it should have responded, liability can be an issue. It is important to note that the monitoring agencies have a certain degree of freedom in determining their policy, so that courts will act reservedly in establishing liability.
The supervisors experience the so-called supervisor's dilemma: if they are not active enough, third parties might start a tort suit against them for the resulting losses. However, if they take measures that in hindsight were not necessary (e.g. withdraw a permit or close an installation), they can be held liable for the negative consequences by the affected actors. Obviously, if the supervisor is held

[28] A.M. Polinksy and S. Shavell, 'Enforcement Costs and the Optimal Magnitude and Probability of Fines', (35) *The Journal of Law and Economics* 1992, p. 133.
[29] See e.g. C.C. van Dam, *Aansprakelijkheid van Toezichthouders*, British Institute of International and Comparative Law 2006 (www.wodc.nl/images/1189_deel1_volledige%20tekst_tcm11-112960.pdf).

liable for the losses caused by a rule violating actor, the supervisor might take recourse on the actual injurer. The administrative costs of such recourse actions, however, can be substantial.[30]

Most monitoring agencies have reported that they are not influenced in their policy by the possible liability claims from third parties. The explanation for this is, that they base their decisions on their ideas of professionalism. The agencies themselves do not plea for abolishment of liability, because they regard the liability claims as a test for their professionalism and quality.[31] Obviously, liability *can* influence monitoring policy, because agencies pay attention to case law in determining their policy. It is not the *fear* of liability, but the possible impact of liability cases of e.g. standards of care that indirectly can influence supervisors.[32]

Kraakman argues that while most legal devices for recruiting private enforcement rely on rewards, this is impossible with 'gatekeepers' (an actor that can prevent misconduct by withholding support, such as not issuing a permit). Their efforts to withhold support from wrongdoing are invisible and difficult to verify, so that we can only observe ex post the occasions where the gatekeeper fails to prevent misconduct ex ante.[33] Imposing liability on failing gatekeepers creates administrative costs. Whether or not these costs are worthwhile depends on the extent in which the threat of liability improves the supervision by the gatekeeper. It is difficult to draw general conclusions on this issue.

5. Monitoring and enforcement of environmental policy as an example

Cohen has given an extensive overview of economic literature on monitoring and enforcement of environmental policy.[34] In this section I will sketch the results of this survey that are most important for the topic of this workshop on monitoring and supervision, and add insights from other relevant literature.

An important way to improve the effectiveness of monitoring is to divide firms that were monitored into two groups. The first group consists of firms that complied at the last inspection and the second of firms that did not comply. Firms in group 2 are subsequently monitored more often, the regulatory standards for them might be tougher and/or the sanctions more severe, as compared to group 1. It appears that this scheme leads to a higher rate of compliance than subjecting all firms to the same monitoring regime.

If firms differ in the effectiveness of an audit, meaning that norm breaking behaviour of some firms is more difficult to detect than such behaviour of other firms, it is best to first audit the firms that are easiest to audit. As the budget for

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30 W.M. Landes and R.A. Posner, 'Joint and Multiple Tortfeasors: An Economic Analysis', (9) *Journal of Legal Studies* 1980, p. 529, 530.

31 See Van Dam 2006, op.cit. (note 29), p. 72.

32 See e.g. Van Dam 2006, op.cit. (note 29), p. 137, 138.

33 R.H. Kraakman, 'Gatekeepers: The Anatomy of a Third-Party Enforcement Strategy', (2) *Journal of Law, Economics, and Organization* 1986, p. 60.

34 M.A. Cohen, *Monitoring and Enforcement of Environmental Policy*, 1998.

audit increases, more firms can be monitored. The firms most difficult to audit might not be monitored at all, which could induce them to pollute as much as they like. This problem might be limited, however, by the fact that a high level of pollution in itself can attract the attention of the auditing agency. Furthermore, firms that value pollution the least should be audited first, because they can be deterred relatively easy. A low probability of detection might already be enough to deter these firms, so that the costs of monitoring them are low.[35] The general insight that monitoring costs lower the optimal rate of compliance, so that one should not strive for maximum but optimum compliance, is also present in the literature regarding enforcement of environmental law.[36]

In the above sections it already became clear that the optimal magnitude of the sanction and the probability of conviction are interrelated. It is possible to save monitoring costs by increasing the magnitude of the sanction, because the lower probability is offset by the larger magnitude of the sanction. However, the possible magnitude of the sanction is limited by the wealth of the offender, ideas of fairness, the need for marginal deterrence and risk aversion. This last argument implies that actors prefer a larger probability of a small loss to a smaller probability of a large loss, the reason behind it being that a twice as large loss in money leads to a more than twice as large loss in utility. After all, actors spend their first euros on the most important needs, and subsequent money is spent on lesser needs. Larger losses therefore also endanger the more important needs. Hence, a tradeoff exists between the desire to lower monitoring costs (by increasing the fine and decreasing the probability of being caught), and the decrease in welfare it causes due to risk aversion.[37]

Another way to decrease the costs of monitoring is to induce *self-reporting behaviour*.[38] This instrument shifts (part of) the monitoring costs onto firms (who now have to investigate whether pollution occurs), which is socially desirable if firms can monitor at lower cost than the government. It is possible to require firms to report violations of environmental standards and to base the possible sanction for violating behaviour on whether the firm indeed reported this. Firms that did report will be subjected to lower sanctions than firms that did not report, to induce them to self-report. Failure to report or submitting false reports could even be labelled as crimes, to make this kind of behaviour very unattractive. Obviously, the higher the sanction for pollution, the more resources firms might spend on trying to evade detection, so that the quality of the self-reports might decrease. Self-reporting introduces new monitoring costs, because the self-reports have to be audited. The total costs decrease if the costs of monitoring behaviour are high and/or the maximum feasible fine is limited. However, self-

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35 I. Macho-Stadler and D. Pérez-Castrillo, 'Optimal Enforcement Policy and Firms' Emissions and Compliance with Environmental Taxes', *UFAE and IAE Working Paper 612.04* 2004, p. 13, 14.

36 See e.g. C. Arguedas, 'Pollution Standards, Costly Monitoring and Fines, *CentER Discussion Paper No. 2005-09* 2005, p. 4, 16, 17.

37 See e.g. A.M. Polinksy and S. Shavell, 'The Economic Theory of Public Enforcement of Law', (38) *The Journal of Economic Literature* 2000, p. 53, 54.

38 See e.g. L. Kaplow and S. Shavell, 'Optimal Law Enforcement with Self-Reporting of Behavior', (102) *Journal of Political Economy* 194, p. 583-606.

reporting probably increases costs if the costs of collecting penalties are high or if the regulator's monitoring technology is very accurate.
Cohen discusses the scarce empirical literature regarding environmental enforcement. Monitoring oil transfer operations and random port patrols designed to detect spills are found to be effective, but routine inspections that are designed to determine if vessels are in compliance with oil spill prevention regulations has no significant effect on spill size.[39] This implies that harm-based sanctions are more effective than act-based sanctions. Furthermore, the implemented change in monitoring policy of the U.S. Coast Guard to classify ships into 'low risk' (infrequently monitored) and 'high risk' (always monitored) turned out to reduce the costs of enforcement, without having a negative effect on the environment. This offers an empirical corroboration of the theoretical idea described above: decreasing monitoring costs by supervising high risks more intensively than low risks. Research on monitoring and fines regarding industry emissions in the U.S. and Canada shows that both methods reduce the levels of pollution, although a 10% increase in fines appears to have a larger impact than a 10% increase in monitoring activity. Most researches also show that firms that were monitored and that complied are less likely to be inspected in the next period.

6. Conclusion

In this paper I have discussed the literature on the economic analysis of optimal law enforcement and the role of monitoring and supervision. Tort law, regulation and criminal law are different instruments for the internalization of negative externalities. These instruments all have strengths and weaknesses, and optimal enforcement requires a mix of all instruments.
Monitoring and supervision in this paper regard the situation where an actor observes the behaviour of another actor, in order to establish whether the latter has acted according to the applicable norms or standards of behaviour. Tort law, which has an ex post character, does not rely on monitoring and supervision in this sense, with the possible exception of vicarious liability, where the principal (e.g. an employer) has incentives to monitor the behaviour of the agent (e.g. the employee), in order to be able to induce him to avoid losses.
Within the context of monitoring, it is possible to distinguish between input and output monitoring, where the former relies on act-based sanctions and the latter on harm-based sanctions. Furthermore, it is possible to preclude damaging acts from occurring in the first place, by applying physical restrictions or force.
A general preference for tort law exists, due to the relative low costs of this instrument. However, problems of judgment proof and a limited probability of being convicted limit the possibilities of tort law. Criminal law has to be used as *ultimum remedium*, due to the high system costs and social costs.
If input and output monitoring are very costly, preclusion is attractive. If input monitoring becomes cheaper (e.g. speed control by radar), act-based sanctions

[39] Cohen 1998, op.cit. (note 34), p. 33.

become more attractive. If output monitoring becomes cheaper (e.g. due to the possibilities of satellites to detect dumping of toxic waste), harm-based sanctions become more important.

The costs of monitoring are just one of the many factors that determine optimal enforcement, so it's importance should not be overstressed. However, because the costs are substantial, they should not be neglected either. Technological changes that decrease the costs of certain monitoring devices leads to a higher level of optimal enforcement, but also to a shift between the different instruments to internalize negative externalities.