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Roger Van den Bergh

Louis Visscher

Rotterdam Institute of Law and Economics (RILE)

Erasmus University Rotterdam

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Roger Van den Bergh ()*, *Louis Visscher (**)*

Abstract:

Given the threats of our current 'risk society', there is an ever-increasing demand for safety regulation to counter the harmful effects of an equally growing number of dangerous activities. Claims for more safety and security abound, ranging from concerns about people killed in traffic accidents and consumers harmed by unsafe products to anxiety about environmental disasters (global warming) and terrorism. This state of affairs poses difficult issues for policy makers. While government resources are necessarily limited, demands for safety and security are in principle without bounds. It is thus unavoidable that difficult choices must be made and priorities must be set.

The Law and Economics literature has developed a comprehensive normative framework to prescribe optimal legal policies when individuals behave rationally. It is well established that enforcement agents should not aim at a minimum level of violations of legal norms but at an optimal level. The main goal of this paper is to apply the insights from the Law and Economics literature on optimal law enforcement to the area of safety regulation. Our paper distinguishes between the form of the sanctions (monetary versus non-monetary), the role of private parties versus public agents in enforcement (e.g. group actions), the timing of the enforcement measures (preclusion, act-based sanctions and harm-based sanctions) and the division of competencies between central enforcement authorities and decentralized enforcement agencies. Furthermore, we discuss several criticisms on the rational choice model (especially related to terrorism) and briefly discuss compliance strategies as alternative approach to deterrence strategies.

Keywords: Safety, optimal enforcement, safety regulation, tort law, criminal law, rational choice, deterrence strategies, compliance strategies, sanctions, private enforcement, public enforcement, terrorism, damages, fines, centralization, decentralization.

JEL Classification: K13, K14, K32, K42.

(*) Rotterdam Institute of Law and Economics (RILE), Erasmus University Rotterdam. E-mail: R.vandenbergh@law.eur.nl

(**) Rotterdam Institute of Law and Economics (RILE), Erasmus University Rotterdam.

OPTIMAL ENFORCEMENT OF SAFETY LAW

Roger Van den Bergh

Louis Visscher

1. Introduction

Given the threats of our current 'risk society', there is an ever-increasing demand for safety regulation to counter the harmful effects of an equally growing number of dangerous activities. Claims for more safety and security abound, ranging from concerns about people killed in traffic accidents and consumers harmed by unsafe products to anxiety about environmental disasters (global warming) and terrorism. This state of affairs poses difficult issues for policy makers. While government resources are necessarily limited, demands for safety and security are in principle without bounds. It is thus unavoidable that difficult choices must be made and priorities must be set. The latter applies to both the formulation of substantive rules and the domain of enforcement. Given the uncertainties, the complexities and the high interests at stake, policy makers face great difficulties if they want to establish safety laws that are efficient from a cost-benefit perspective. In the case of catastrophic risks, the adoption of the precautionary principle indicates that the law should err on the side of environmental preservation.¹ In other areas of law, such as traffic safety and consumer protection, the risk of counterproductive safety measures has been documented empirically.² These examples show that policy makers face difficulties in prioritizing risks in a way that scarce resources are not wasted and in avoiding the implementation of safety regulations that have worse consequences than the risks they are supposed to deal with. These problems will not be discussed further in this paper. Rather, the main focus will be on the challenges in the area of enforcement. Optimal outcomes require the choice of an appropriate sanction in case of violation of safety rules. This sanction must be imposed timely and at the optimal level of government. Moreover, since resources of public authorities are inevitably limited, the potential role of private enforcement equally has to be considered.

The Law and Economics literature has developed a comprehensive normative framework to prescribe optimal legal policies when individuals behave rationally. The economic approach to law provides important insights for policy makers who wish to achieve 'optimal deterrence'. Economic analysis of crime has been concerned with individual deterrence from the perspective of a rational individual actor, who maximizes his or her individual benefits. Following the basic insights from Gary Becker, potential criminals commit an offence if the gains from committing the crime are larger than the expected costs in terms of probability and severity of punishment.³ In addition, at the level of society, it is well established that enforcement agents should not aim at a minimum level of violations of legal norms but at an optimal level. Benefits of more enforcement have to be weighed against the costs of en-

¹ A. Arcuri, 'The case for a procedural version of the precautionary principle erring on the side of environmental preservation', in: M. Boyer, Y. Hiriart, and D. Martimort (Eds.), *Frontiers in the Economics of Environmental Regulation and Liability*, Hampshire: Ashgate 2006, p. 19-63.

² S. Peltzman, 'The effects of automobile safety regulation', (83) *Journal of Political Economy* 1975, p. 677-725; W.K. Viscusi, 'The lulling effect: The impact of child resistant packaging on aspirin and analgesic ingestions', (74) *American Economic Review. Papers and Proceedings* 1984, p. 325; W.K. Viscusi, *Fatal Trade-Offs: Public and Private Responsibilities for Risk*, New York: Oxford University Press 1992.

³ G.S. Becker, 'Crime and punishment: an economic approach', (76) *Journal of Political Economy* 1968, p. 169-217.

enforcement measures and enforcement efforts should thus be increased only up to the point where their marginal costs equal the marginal benefits. It is socially desirable to allow a certain degree of unsafe, norm breaking behaviour if the costs of avoiding violations are higher than the benefits of additional deterrence. The main goal of this paper is to apply the insights from the Law and Economics literature on optimal law enforcement to the area of safety regulation.

The structure of this paper follows Shavell's distinction of the three basic dimensions according to which methods of law enforcement can differ: the form of the sanctions, the role of private parties versus public agents in enforcement, and the timing of the enforcement measures.⁴ In a federal or quasi-federal context, such as the European Union, a fourth dimension must be added: the division of competencies between central enforcement authorities and decentralized enforcement agencies. The question addressed in the second section of the paper relates to the sanctions. A basic choice is to be made between monetary sanctions (private damages, administrative fines, criminal fines) and imprisonment. Generally, if sanctions are too low, the expected benefits from violating the safety rules may exceed the expected costs of infringing the law and under-deterrence will result. The third section discusses the question relating to the enforcement agents: not only public enforcement authorities but also private parties bringing cases before courts can play an important role in the enforcement of safety rules. The third section examines the advantages and disadvantages of private enforcement to find out whether, from an efficiency perspective, private damages actions are an alternative for or a desirable supplement to enforcement by public authorities. The question discussed in the fourth section of the paper relates to the timing of the enforcement measures. Intervention may take place before a dangerous act is committed, after the occurrence of the undesirable act, or after harm has been inflicted upon society. The fourth section gives an overview of the theoretical economic literature, which sheds some light on these questions, and applies the insights to particular areas of safety law. The fifth section of this paper discusses the fourth question relating to the choice between a centralized enforcement system by a single public authority and decentralized enforcement by different agencies at lower levels of government. Decentralized enforcement implies shared competences and may enable competition between enforcement agencies. Whether this regulatory competition at the enforcement level is benign is the last question to be addressed in the fifth section. All insights on optimal enforcement of safety laws that are developed in sections 2 to 5 are based on the rational choice model used in the economic analysis of law. The sixth section of the paper pays some attention to the criticisms on this rational choice model and briefly discusses alternative approaches. Finally, the most important conclusions are summarized in the seventh section of the paper.

2. The choice of the sanction

2.1 Unsafety as negative externality

Several dangerous activities generate harmful effects to persons who do not engage in those activities. Examples include traffic accidents, products causing losses, dangers at work due to unsafe machines or materials used, and environmental losses. In economic terms, these dangers form negative externalities, *i.e.* costs borne by others than the parties causing them. If an actor does not have to bear the full costs of his activity, (s)he will take the wrong decisions in

⁴ S. Shavell, 'The optimal structure of law enforcement', (36) *Journal of Law and Economics* 1993, p. 255-287.

deciding how often to engage in the activity and how carefully to do this. Viewed from the perspective of maximizing social welfare, (s)he will engage too often in dangerous activities and will not take sufficient care. The actor will only reduce the activity level if the private losses resulting from the activity decrease by more than the foregone benefits, and (s)he will only take more care if the decrease in personal expected accident losses outweighs the increase in care costs. In this calculation, the actor neglects the costs (s)he imposes on third parties, which from a societal point of view should be incorporated just as well. Legal instruments can be used to let the actor internalize the externality, so that (s)he will better weigh costs and benefits of taking care, and/or choose a better activity level. It may be added that in the case of intentional torts, crimes and terrorist attacks, the negative externalities are not caused inadvertently, but on purpose. The actor therefore does not spend too little on taking care, but (s)he actually spends resources to enable the dangerous act. In essence, care costs are negative.⁵ This in itself is already a waste of resources, so that the act lowers social welfare. Furthermore, the acts often cause more losses to the victim than gains to the actor, which further reduces social welfare.⁶

Tort law, regulation and criminal law all provide behavioural norms, which can help in increasing social welfare. Tort law provides rules to evaluate whether an actor has taken enough care while engaged in his or her activities (negligence) or it shifts the losses to this actor irrespective of the care level chosen (strict liability). Regulation provides detailed norms as to how actors should behave, which safety measures they should take, which diplomas and training they need, and it opens the possibility of sanctioning actors who do not meet the requirements. Criminal law poses monetary and non-monetary sanctions on undesired behaviour. Hence, different legal instruments to enhance safety exist. Enforcement of the behavioural norms can reduce the number and/or severity of violations of these norms, because the actor who considers such a violation is confronted with the possibility of a sanction, which lowers his or her net private benefits. This deterrence potential is the central focus of the economic analysis of safety law.⁷ Different legal instruments use different types of sanctions to achieve deterrence. In the section below these sanctions will be discussed and compared in detail.

2.2 *Internalization through damages, fines and imprisonment: an economic appraisal*

In order to induce actors to make a correct weighing of all costs and benefits of their activities, the externalities should be fully internalized. Only then will actors incorporate all relevant costs and benefits in their decisions. This implies that the size of the sanction should vary with the size of the externalities caused. Tort law, regulation and criminal law differ in the way in which internalization is aimed for.

2.2.1 *Damages*

The principal remedies in tort law are damages and injunctions. Both remedies have the potential to deter the potential wrongdoer from the dangerous act. An injunction is a direct way

⁵ R. A. Posner, *Economic Analysis of Law* (6th edition), New York: Aspen Publishers 2003, p. 206.

⁶ D.D. Ellis, 'An economic theory of intentional torts: a comment', (3) *International Review of Law and Economics* 1983, p. 50.

⁷ Obviously, in as far as the sanction consists of the obligation to pay tort damages, the victim is compensated for the loss suffered. This goal, which is regarded as the central goal of tort law by many lawyers, will not be further discussed in this paper, as the focus is on the potential of the different legal instruments to enhance safety by deterring norm-breaking behaviour.

to prevent the behaviour, by simply forbidding it. Obviously, the potential injurer might decide to carry out his behaviour after all, so that an additional sanction is needed to enforce the injunction. Damages form an indirect deterrence instrument, designed to induce the actor to increase the care level and/or to lower the activity level. The literature on economic analysis of tort law is very extensive⁸ and cannot be dealt with in detail within the confines of this contribution. However, a short discussion of efficient liability rules in cases of unilateral accidents (where the victim has no impact on the expected accident losses) may suffice to illustrate the way in which liability rules may contribute to achieve an optimal level of safety. Under a rule of strict liability, the injurer is always liable and therefore always bears the costs of care and the costs of the accidents that still occur at this care level. The injurer will therefore spend an additional euro on care as long as this yields at least one euro in decreased expected accident costs. Hence, (s)he will take the optimal care level where the sum of care costs and expected accident losses is minimized. Furthermore, because the injurer internalizes both the care costs as well as the expected accident losses, (s)he will only engage in the activity if these costs are lower than the utility yielded by the activity. Hence, (s)he also chooses an optimal activity level. Under a negligence rule, if the courts base the due care level on a proper weighing of costs and benefits of care, the injurer also chooses the optimal care level. It is cheaper for him/her to take due care and not be liable, than to take less than due care and be liable. If courts place the due care level higher or lower than the optimal care level, however, the injurer will follow this incorrect due care level if (s)he can predict it. If the injurer cannot predict the error of the court, (s)he will most likely take excessive care, to lower the chance of being held liable and having to bear the expected accident costs.⁹ In any case, by taking due care, the injurer avoids having to bear the expected accident losses. The injurer therefore externalizes these costs onto the victim. As a result, his or her activity level will be higher than optimal.

The behavioural incentives provided by the tort system flow from the duty to pay damages. Therefore, in order for tort law to lead to optimal deterrence, tort damages under strict liability should lead to full internalization, and under negligence they have to be high enough to make optimal care (which is based on full internalization) more attractive than lower care plus liability. Unfortunately, tort law suffers from some problems, which endanger the ideal of optimal damages.

First, the ‘probability of conviction’, *i.e.* the probability that an injurer who has committed a tort will actually have to pay damages, will be lower than 100 percent. Some victims might not file a claim, *e.g.* because they think that they will not be able to prove negligence, causation and/or their losses, or the costs of bringing a claim outweigh the damages that might result. The latter problem is known as ‘rational apathy’: victims do not sue injurers because it is not worth the efforts. As it will be argued in Section 3 below, collective actions might ameliorate this situation. If the probability of conviction is below 100 percent, injurers are not confronted with all expected losses they cause and they receive inadequate incentives, which leads to under-deterrence. This problem might be solved by using punitive damages, where the damages are multiplied by the reciprocal of the probability of conviction. However, many

⁸ See, among many others R.D. Cooter and T.S. Ulen, *Law and Economics* (4th Edition), Boston: Pearson Addison Wesley 2004, p. 307-387; Posner 2003, *op.cit* (note 5), p.167-213; S. Shavell, *Economic Analysis of Accident Law*, 1987, Cambridge: Harvard University Press; S. Shavell, *Foundations of Economic Analysis of Law*, Cambridge, Massachusetts: The Belknap Press of Harvard University Press 2004, p. 175-287 and H.-B. Schäfer and C. Ott, *The Economic Analysis of Civil Law*, Cheltenham: Edward Elgar 2004, p. 107-269.

⁹ J.E. Calfee and R. Craswell, ‘Some effects of uncertainty on compliance with legal standards’, (70) *Virginia Law Review* 1984, p. 965-1003; R. Craswell and J.E. Calfee, ‘Deterrence and uncertain legal standards’, (2) *Journal of Law, Economics and Organization* 1986, p. 279-303. Only if due care is set at an extremely high level, the injurer may prefer to take optimal care and accept liability in case of an accident.

countries do not accept punitive damages. Without this instrument, the maximum financial sanction in tort law is limited to the extent of the losses.

A second problem is caused by the possibility that the injurer is ‘judgment proof’, meaning that he cannot pay the full damages. Especially in situations where the injurer might cause large losses, this problem can create severe under-deterrence, and it is exacerbated when using punitive damages. If the injurer cannot pay the damages, (s)he receives inadequate financial incentives. The injurer does not incorporate the full expected accident losses in his or her care- and activity decision, but merely the expected liability, which is based on his or her lower assets. Vicarious liability might solve this problem, provided that the principal has adequate assets, and non-financial incentives to influence the agent. In cases where the principal (*e.g.*, an employer) has better information regarding the costs and benefits of care measures and/or the applicable norms of behaviour than the agent (*e.g.*, an employee), vicarious liability enables the former to provide better incentives to the latter than tort liability could have done. However, vicarious liability creates monitoring costs, because the principal has to supervise the agent in order to be able to determine his or her care level.¹⁰ The better incentives have to be weighed against the increased system costs.

Third, not all losses caused by the injurer might be compensated. Especially immaterial losses (such as pain and suffering, loss of life, *et cetera*) and highly subjective and/or uncertain losses (such as the personal valuation of a unique good that has been destroyed, and the loss of future income) are likely to be undercompensated, due to their uncertain and speculative nature.

2.2.2 Administrative fines

Administrative fines are financial sanctions imposed by a governmental authority after a norm violation has been established. Regulation forms an *ex ante* approach, where governments issue more or less detailed behavioural norms, as opposed to the *ex post* character of tort law. In cases where the government possesses superior information as compared to the courts, regulation can provide better guidelines for behaviour than strict tort liability or negligence can. Comparable to tort law, regulation can prohibit a certain dangerous behaviour (*e.g.* by withholding a necessary permit) or it can make a norm violation financially unattractive, by subjecting it to a fine. The magnitude of the fine is not limited to the losses the injurer might cause by his or her violation. Fines therefore have a more flexible character than tort damages, because the magnitude can be varied.¹¹ Furthermore, fines can be attached to norm breaking behaviour, irrespective whether losses have occurred, and/or to harmful behaviour. Tort damages can only be attached to the latter. This difference will be analyzed in more detail in section 4 on the timing of sanctions. Besides the possible superior information of the government, economies of scale form an additional advantage of regulation. After all, the government can investigate into the risks of certain activities, and convey the information to actors who themselves could not have afforded this research.

A disadvantage of regulation, as compared to tort law, is the fact that the regulator might be susceptible to the influence of interest groups. If these groups are able to influence the decision making process, the resulting regulation might not succeed in internalizing all externalities, but might rather advance the interests of successful pressure groups, possibly to the det-

¹⁰ R. H. Kraakman, ‘Vicarious and corporate civil liability’, in: B. Bouckaert and G. De Geest (Eds.), *Encyclopedia of Law and Economics. Volume II. Civil Law and Economics*, Cheltenham: Edward Elgar 2000, p. 670, 671.

¹¹ G. De Geest and G. Dari-Mattiacci, ‘On the intrinsic superiority of regulation plus insurance over tort law’, *Working paper Utrecht University, Institute of Economics* 2003.

riment of social welfare. Furthermore, in issuing regulation, the government often has to rely in part on information issued by the parties who are regulated. They might only provide the information that is beneficial to them. This problem is known as *regulatory capture*.¹² Finally, fines suffer from the judgment proof problem just as damages do. If the norm violator cannot pay the fine, (s)he will not be deterred by it. An important difference in this respect is that fines can be based on the norm violation, whereas damages can be attached only to the occurrence of losses. Because not all norm violations lead to losses, the sanction on norm violation can be lower than the sanction on harmful behaviour, so that the judgment proof problem is less severe with the former type of sanction.¹³

2.2.3 Criminal fines and imprisonment

In his seminal paper *Crime and Punishment: An Economic Approach* published in 1968, Gary Becker distinguishes several factors that are relevant in determining optimal enforcement in criminal law. The first factor is the harm caused by the crimes, *i.e.* the negative externalities diminished by the gain of the offender. The second factor is the costs of apprehension and conviction. The third factor, the supply of offenses, depends on the probability of apprehension and conviction and the severity of the sanction. An increase in the probability appears to have a greater effect than an increase in the punishment. Also factors such as income and law-abidingness due to education are relevant. The last factor is the total costs of punishment, which comprise the cost to offenders plus the cost or minus the gains to others. According to Becker, the criminal justice system should aim at minimizing the total social costs of crime.¹⁴

Criminal fines, just as administrative fines and damages, are financial sanctions that seek to deter an actor from committing a wrongful act. They have the same flexibility as administrative fines, in the sense that their magnitude and timing are not restricted to the size and the occurrence of losses. However, being involved in a criminal procedure causes negative reputational effects and after a conviction, the actor might have a criminal record, which can have negative consequences for an extended period. Hence, criminal fines might be experienced as more serious than administrative fines. In terms of deterrence, this can give criminal fines an advantage over administrative fines, because it is not only the money-value that is decisive, but also the negative associations that are attached to them.¹⁵ These negative associations of criminal law, however, form an important reason to use criminal sanctions as an *ultimum remedium*, so that criminal fines should only be applied if administrative fines do not produce the desired result. In section 2.3 regarding enforcement costs this issue will be discussed in more detail.

Imprisonment is a non-financial sanction, and therefore it radically differs from damages and fines. This difference provides a possible solution to the judgment proof problem. After all, an actor that cannot pay damages or a fine might be deterred by the prospect of possible imprisonment. Furthermore, the fact that criminal sanctions, especially imprisonment, are regarded as highly intrusive can solve the problem of a low probability of conviction. The negative association that people generally have with criminal activities can already prevent them from engaging in such activities. However, this requires that criminal rules remain ex-

¹² 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.

¹³ Shavell 1993, *op.cit* (note 4), p. 261 ff.

¹⁴ Becker 1969, *op.cit* (note 3).

¹⁵ Also see A. Ogus and C. Abbott, 'Sanctions for pollution: do we have the right regime?', (14) *Journal of Environmental Law* 2002, p. 287 and 292.

ceptional. The more types of undesired behavior are treated as crimes, the less this 'self-enforcement' will occur.

2.3 Enforcement costs

An important topic in the literature regarding optimal enforcement is that the enforcement costs should not outweigh the benefits in terms of deterrence. Society should therefore not strive for maximal enforcement, but for optimal enforcement. This implies that some norm violations have to be accepted, simply because it is too expensive to also deter these violations. 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. The methods of internalization described above differ in the enforcement costs they entail.

Tort law is regarded as a relatively cheap instrument, because it uses open norms that are easy to formulate and that only have to be specified after an accident has happened, *i.e. ex post*. Given that many cases are settled outside of court, or are dealt with administratively by insurance companies, the system costs will be relatively low. In cases that are being tried, the costs of lawyers and courts will increase the system costs. Since the predominant actor in tort law is the victim, who has to sue the injurer, there are no or only little monitoring costs. Even though tort law may be regarded as relatively cheap to achieve deterrence, research suggests that it is much more costly as a method to compensate harm. For every euro that is paid in compensation to the victim, an additional euro has been spent on system costs. This makes tort law much more expensive than a pure insurance scheme, where assessments of the system costs vary from one to fifteen percent. However, a pure insurance scheme might score worse on deterrence.¹⁶

Regulation causes higher system costs than tort law. To start with, formulating detailed *ex ante* norms is much more expensive than formulating the open *ex post* norm of careful behaviour in tort law. Furthermore, because regulations are issued by different authorities, problems of inconsistency can occur (*e.g.* fire regulation requires the doors of a day-care center to be unlocked, while regulation regarding the safety of the children requires them to be locked so that the children cannot leave the building). Third, the *ex ante* character of regulation requires monitoring of all behaviour, including both norm abiding and norm violating acts. For example, not only speeding motorists are checked but all motorists, and not only carnivals with unsafe equipment are visited, but also carnivals where everything turns out to be safe. Theoretically, the costs of monitoring could be decreased by reducing the level of monitoring while increasing the magnitude of the fine, but the judgment proof problem poses limits to this solution.

Criminal law entails even higher enforcement costs than regulation. The negative impact of a conviction on the actor involved, such as the reputational loss or stigma, the possible impact on work and personal relations and time going to waste during imprisonment, calls for procedural safeguards to avoid wrongful convictions. The punitive element lowers social welfare, because there is no offsetting gain. This problem is larger with imprisonment than with fines, because a fine is a transfer of money, while imprisonment creates additional harm. The nega-

¹⁶ See *e.g.* D. Dewees, D. Duff and M.J. Trebilcock, *Exploring the Domain of Accident Law. Taking the Facts Seriously*, New York: Oxford University Press 1996, p. 26.

tive consequences of a wrongful conviction, especially when imprisonment is involved, are regarded as much more serious than the negative consequences of a wrongful acquittal in criminal law. In administrative law and tort law, the difference between such *type 1* and *type 2* errors is much less severe, so that fewer safeguards are needed here. Due to the safeguards in the criminal procedure, authorities have to collect more information in order to secure a conviction. This increases the enforcement costs. Furthermore, imprisonment is a costly sanction, because it requires special buildings and trained guards. The officials involved should be monitored themselves, to avoid abuse of power.

It is an interesting question whether the high costs of criminal law could be reduced by ‘privatization’ of criminal law. After all, it is generally argued that private firms operate more efficiently than the government does, due to the forces of competition. Government officials receive no or only little incentives to produce efficiently, and ‘customers’ who are not charged with the full costs of a service (e.g. police) will demand too much of this service. Furthermore, due to differences in preferences and ability to pay for safety, the desired level of safety might differ per person. The price mechanism is better able to fine-tune the supply of safety to those differences, than the government can, simply because the government lacks the necessary information.¹⁷ With fines, private monitoring agencies could be allowed to retain (part of) the fine, making it a profitable enterprise. With imprisonment, the firms could be rewarded for every conviction that was dependent on their efforts.

However, privatization of safety also poses problems. First, there is a risk of a too high level of prosecutions. In the economic model, probability of conviction and magnitude of the sanction are negatively correlated, because it is the *expected* sanction (probability times magnitude) that is decisive. A private firm, however, will be induced to increase the probability of conviction if the sanction (which determines their reward) is higher.¹⁸ Overall private enforcement could also turn out to be lower than public enforcement, because private firms will only be willing to invest in enforcement if they can at least break even.¹⁹ Second, private firms might have no incentive to incorporate the interests of the suspects in their decisions, while in Becker’s model on the economics of crime and punishment these interests do have to be taken into account in determining the proper enforcement policy.²⁰ On the other hand, private firms are susceptible to negative publicity and possible tort claims arising from maltreatment. Empirical evidence regarding private prisons indicates that they function more efficiently than public prisons, and that the inmates are generally treated better.²¹ Third, it is undesirable if several private firms compete on a market where a monopolist would be more efficient, due to e.g. the need for one centralized database with fingerprints, DNA-samples *et cetera* (a so-called ‘natural monopoly’). Even if fierce competition would lead to one surviving monopolist in the end, it remains to be seen if a private monopoly is preferable over a public monopoly, especially because it entails the exclusive right to apply force.²²

¹⁷ H.O. Kerkmeester, ‘Privatisering van veiligheid: economische aspecten’, in: L.C. Winkel *et al.* (red.), *Privatisering van veiligheid*, Den Haag: Boom Juridische uitgevers 2005, p. 86, 87.

¹⁸ W.M. Landes and R.A. Posner, ‘The private enforcement of law’, (4) *Journal of Legal Studies* 1975, p. 9 ff. Friedman argues that Landes and Posner did not prove that private enforcement would lead to over enforcement, because they merely distinguish situations of over enforcement and under enforcement, but do not establish that the former is more likely to occur than the latter. See D.D. Friedman, ‘Efficient institutions for the private enforcement of law’, (13) *Journal of Legal Studies* 1984, p. 384.

¹⁹ A.M. Polinsky, ‘Private versus public enforcement of fines’, (9) *Journal of Legal Studies* 1980, p. 113 ff.

²⁰ Becker 1968, *op.cit* (note 3), p. 173 and 180.

²¹ See Kerkmeester 2005, *op.cit* (note 17), p. 90, referring to A. Tabarrok (Ed.), *Changing the Guard: Private Prisons and the Control of Crime*, Oakland: The Independent Institute 2003.

²² Kerkmeester 2005, *op.cit* (note 17), p. 84.

Ogus and Abbot have analyzed the use of sanctions for pollution in England and Wales, by applying the insights regarding optimal enforcement. The Environment Agency has the power to start criminal proceedings, but this is rarely done, due to the high safeguards in criminal law. Only if the Agency “is satisfied that there is sufficient, admissible and reliable evidence that the offence has been committed and there is a realistic prospect of conviction”, a prosecution will be started.²³ The Agency also can apply the administrative tools of suspension and revocation of a permit. However, this is regarded as such a heavy sanction - the authors compare it to incapacitation of the offender- that the threat to apply it is not considered as credible.²⁴ Criminal sanctions are often regarded as more intrusive than administrative sanctions, but in pollution cases, suspension and revocation are actually more severe than a criminal fine. The traditional safeguards of criminal law are not necessary for criminal fines in a regulatory setting, because the defendants are mostly firms and the stigma may not be serious.²⁵ The authors therefore advocate introduction of administrative fines, which would provide the Agency with a credible sanction.²⁶ On the other hand, due to the severity of administrative suspension and revocation, the same procedural safeguards as in criminal law should apply there and they should only be used if fines are not effective.²⁷

3. Public or private enforcement

The Law and Economics literature has advanced criteria that allow an assessment of the relative efficiency of private and public enforcement of law. Both private and public enforcement have a number of strengths and weaknesses. Two determinants allow to make an informed choice between public or private enforcement, – or opt for a combination of both. The first criterion relates to the availability of information concerning law infringements and the identity and location of the wrongdoer. The second criterion refers to the need to exclude both under-enforcement and over-enforcement. Private enforcement will be economically optimal if: i) private parties possess information on violations of safety protection laws and ii) the private interests of going to court coincide with the socially optimal enforcement level. Conversely, public enforcement is preferable to private enforcement if: i) public agents enjoy an information advantage over private parties in discovering infringements of safety rules, or ii) the private motives to bring law suits are not identical with the social benefits of law enforcement.

At the outset, it should be pointed out that both criteria in favour of either private or public enforcement may not be simultaneously satisfied. Private parties possessing information about infringements may not have incentives to initiate legal proceedings if the costs of enforcement exceed the benefits (for example, in cases of trivial damages). This ‘rational apathy’ problem will lead to under-enforcement. Private parties may also expand their enforcement activities beyond the socially optimal level for opportunistic reasons. In cases where there is a risk of suboptimal enforcement, it may be preferable to opt for a combination of both systems of enforcement, so that they can mitigate each other’s disadvantages. Below, both criteria for choosing between public and private enforcement will be discussed in more detail and applied to the domain of safety regulation.

²³ Ogus and Abbott 2002, *op.cit* (note 15), p. 287.

²⁴ *Idem*, p. 294.

²⁵ *Idem*, p. 294.

²⁶ *Idem*, p. 296.

²⁷ *Idem*, p. 298.

3.1. Information advantages of public enforcement agencies

In designing an economically optimal system of enforcement, the first determinant is the availability of information. If private parties can easily discover law infringements, other things being equal, then it is not socially desirable to have the state spend its resources on enforcement activities. By contrast, if it is very difficult and/or costly to discover infringements and identify law infringers and the location of the infringements, then public enforcement may be more adequate.

In a typical tort case, the victim knows the injurer or the costs of identifying the injurer are low.²⁸ Private parties initially possess information unknown to the state about the identity or location of liable parties, or even about the occurrence of an accident in the first place. The victim will usually have incentives to supply this information to the courts in order to be able to collect damages. Society would spend its resources needlessly if it was relying on the state to report harms leading to civil liability. However, the picture may change if safety regulations are violated. First, it may be difficult for individual victims to recognize unsafe products in markets characterized by information asymmetries. Second, victims will often remain unaware of infringements before harm has occurred. Public enforcement will be preferable if it is costly to identify the infringement and/or the law infringer. From an economic perspective, it can be easily understood why enforcement of regulation of safety and health is primarily public. Private parties are not aware of the full size of the risks. If a restaurant kitchen is unclean but a consumer does not get sick when he goes to the restaurant, how will (s)he know the status of the kitchen? The state will need to spend resources on public enforcement, in order to guarantee that law infringers are identified and sanctioned. Another example is the requirement of a permit to operate a factory, which is delivered conditional upon the compliance with environmental regulations. Individuals may be unaware of the licence requirements and face great difficulties in controlling compliance with *e.g.* the very technical requirements regarding emission of dangerous substances. Private individuals largely remain unaware of violations of those rules as long as no (substantial) harm has occurred and, even afterwards, will face difficulties to prove violation of the relevant safety rules. Conversely, public enforcement agencies may build up expertise in controlling compliance with technically complex safety rules and may be given investigative powers to detect infringements.

3.2. The social benefits of enforcement deviate from the private benefits

Generally, legal rules do not only protect the private interests of harmed individual parties but also the interests of society at large. From an economic perspective, the full social losses must be compensated to force tortfeasors to internalize the negative welfare effects of their behaviour. However, private parties will initiate legal proceedings only if the private benefits of doing so are higher than the private costs. The private costs consist of the information costs that must be borne to discover the law infringements, the costs of the court procedure and the costs to prove the size of the damage and the causal link between the infringement and the harm. The private benefits consist of the monetary sanction imposed on the law offenders (assuming that there is no judgement proof problem)²⁹, as far as this will improve the financial situation of the private claimants. This private cost-benefit calculus has no systematic relation with the social costs and benefits. The social costs also comprise the harm suffered by victims who do not sue and other losses that cannot easily be attributed to individual

²⁸ Landes and Posner 1975, *op.cit* (note 18), p.31.

²⁹ S. Shavell, 'The judgement proof problem', (6) *International Review of Law and Economics*, p. 43-58.

victims. Since potential plaintiffs are driven only by the private gains and expenses of their claims, they will have insufficient incentives to invest in detecting and litigating meritorious cases. In addition, a system of private enforcement creates a ‘free riding’ problem. Every victim of a law infringement has an interest to leave the enforcement efforts to other victims, so that profits can be obtained without having to spend own resources. The free riding problem will reduce the number of private actions below the level of enforcement that would be socially optimal.

If private interests and social interests do not coincide, private parties will have no incentive to bear enforcement costs even if this would be in the public interest. As indicated by Shavell, the possibility of financial reward coupled with the desire to avoid future harm and the retributive motive (the desire to see people who have acted wrongly suffer sanctions) may create a set of incentives sufficient to induce people to report the information they possess about wrongdoers.³⁰ However, the size of these private benefits will vary across different fields of law and will not always generate optimal law enforcement efforts. Again, in a typical tort case, the private benefits from successfully suing a wrongdoer will be identical with the social benefits. If a house burns down in a fire caused by negligent behaviour of a tortfeasor, the value of this house is lost for society as a whole. The private loss equals the social loss.³¹ Conversely, rules of safety law protect the private interests of individual parties but are also indispensable for avoiding larger social losses. Individual victims will have insufficient incentives to report infringements of safety protection laws, if their private benefits are lower than the social losses resulting from an overall reduction of safety and security.

Several causes may explain why individual victims will not spend optimal efforts on enforcement of safety rules. The financial reward will be small if the loss consists of trivial damages; in such a case the costs of the law suit typically exceed the expected compensation. The financial reward will be non-existent if the law infringer is insolvent. The costs of private damages actions may be higher than the expected benefits if the law infringement can be assessed only with great difficulty, such as in the case of violation of technically complex safety rules. In cases where the harm is already suffered, the desire to avoid future damage may not provide incentives because of the free riding effects generated by private enforcement. Why would an individual victim bring a claim against a polluting factory to stop dangerous emissions and avoid harm to other private parties who do not bear (a part of) the financial burden of the enforcement action? Finally, the retributive motive does not seem sufficient to compensate the above shortcomings of private damages actions.

3.3. Group action as a potential remedy to the inefficiencies of private enforcement

Before concluding that private damages actions are a defective enforcement mechanism for sanctioning infringements of safety rules and jumping to public enforcement, one should investigate whether adaptations of the institutional legal framework for private enforcement may overcome the existing inefficiencies.³² More in particular, private incentives to sue in-

³⁰ Shavell 1993, *op.cit* (note 4).

³¹ An exception are claims for compensation of pure economic losses. If electricity supply is cut off for a number of hours due to negligent behaviour of a contractor charged with repair works, bars and restaurants in the affected area will have to close and will lose business. Since consumers will go to different places to have a drink or enjoy a dinner, the value of this business is not lost but simply moves to competing traders. In the latter example, private losses and social losses are not equal.

³² See also W. van Boom, *Efficacious Enforcement in Contract and Tort*, Den Haag: Boom Juridische uitgevers 2006.

fringers may be influenced by creating the possibility of group actions. Group action schemes can take two different forms: i) either collective actions, allowing a group of victims to have their collective interests protected in a single claim brought on behalf of the entire group, or ii) representative actions brought by associations, which represent their members or may act also on behalf of non-identified victims. The question arises whether group actions may overcome the aforementioned problems. First, it should be investigated to what extent a group action may cure the information deficiencies with respect to law infringements. Second, it must be examined whether group actions may solve the rational apathy problem. Third, one should look for the type of group action which best overcomes the free-riding problem.

There are several ways in which group actions could solve, or at least diminish, the information deficiencies. In this respect, one must distinguish between collective actions and representative actions. Under opt-in schemes, victims must be appropriately notified about the occurrence of an infringement that has caused harm to them. Economically speaking, the value of the information provided is higher than the costs of the notification if it incites victims to initiate a group action to recover damages. Benefits resulting from the reduction of information asymmetries may be particularly large in the case of representative actions. Associations may more easily acquire specialized knowledge regarding the applicable laws than individuals, so that they are better able to assess whether a certain behaviour constitutes an infringement. Obviously, there still will be an information asymmetry regarding possible infringements in as far as they are not easily detectable. Detection requires monitoring and supervision, which is costly. For individual victims these costs are almost by definition insurmountable but associations might acquire adequate funding for such investigations by charging their members a membership fee or by means of sponsoring. Thanks to group actions economies of scale can be achieved. It is more expensive for individual victims to investigate possible infringements in their own separate cases than for a group of victims, who jointly initiate legal proceedings. The achievable economies of scale are larger under an opt-out scheme than under an opt-in scheme, since the number of harmed victims reached will be larger. Economies of scale are even more important if the investigation is done by an association which can monitor potential wrongdoers more regularly.

Group actions may also mitigate the rational apathy of individual victims and the free-riding problem. First, group actions allow compensation of the losses of an entire group of harmed victims. This increases the number of lawsuits, because the expected net benefit will be higher than in the case of an individual claim. After all, the costs of the lawsuit decrease while the probability of winning the suit (and thereby the expected utility as well) increases if multiple plaintiffs have larger financial means, enabling them to have better access to evidence and get better legal advice. The problem of rational apathy is therefore reduced. Second, group actions spread the risk of uncertainty over a large number of affected victims. The financial effects of losing the case are spread over all individuals participating in the collective action, so that each individual only bears a small amount if the case is lost. People are better able to bear a small loss than a larger loss, so that the barriers to start a lawsuit are lowered. This will increase the number of claims brought in courts. Third, the free-riding problem can be overcome if those who benefit from a successful collective action are forced to contribute to its costs. Collective actions initiated by associations mitigate the free-rider problem, in as far as the association is able to charge its members a fee for the costs incurred.

Even though collective actions may improve information flows, cure rational apathy of individual victims and overcome the free-riding problem, these advantages also come at a cost. There are two main disadvantages: i) principal-agent problems, which result from informa-

tion asymmetries on the side of victims inhibiting them to control the quality of the performance of the representing (association's) advocate, and ii) the risk of opportunistic behaviour, which may lead to frivolous suits. These problems have materialized with US class actions and have often led European policy-makers to argue against the introduction of collective actions. It is well known from the literature on the regulation of the legal profession³³ that clients (principals) face great difficulties in controlling the quality of the performance of the lawyers (agents). Information asymmetries exist which make it difficult or even impossible for the client to assess the quality of the lawyer's work. In individual cases, the client has an immediate interest so that he may try to monitor his lawyer's efforts to a certain extent. In collective actions, however, the plaintiffs' interests are often too small to undertake any monitoring activities. In American class actions the attorney thus becomes the leading actor of the case and may pursue his private interests to the detriment of the harmed group of victims as a whole. The principal-agent problems may be exacerbated by the way in which the collective action is funded. Even though contingency fees may allow financing the costs of the suit (and thus improve access to justice), they may reduce the attorneys' efforts below the optimal level and may lead to early settlements that are disadvantageous for the clients. The American experience also shows that class actions may be initiated to inflict reputational harm on companies. Firms may prefer an early settlement if this costs them less than the sum of the losses of handling the case in court. The size of these losses creates scope for abuses if the amount of damages to be paid by the company is lower than the costs of defending itself in court. This can even happen if the class attorney is certain that (s)he will lose the case, because the costs of the defendant of going to court (e.g. legal fees and reputational harm) might outweigh the settlement amount.

3.4. Examples of group actions in Europe, especially in the Netherlands

When looking at the legal possibilities for collective actions in Europe, it is noticeable that most countries do not open the possibility for a collective action for damages. Even though in many countries private associations or public bodies have been granted standing so that they can bring a representative action, these rights are often limited to file for an injunction, or a declaratory decision regarding the unlawfulness of the defendants' behaviour. In Germany, unlawfully obtained profits can be disgorged in a collective action. In the United Kingdom, collective actions for damages are available. In addition, specified bodies (allowed by the Secretary of State) are permitted to bring representative follow-on actions for infringement of competition law before the Competition Appeal Tribunal.³⁴ In Belgium, Finland,³⁵ Denmark and Italy, proposals pertaining to representative collective action for damages have been submitted. In Sweden, collective actions for damages have been possible since 2003. Prerequisites are that the facts are identical and that it is sensible to decide the disputes in a single trial. An opt-in scheme has been chosen to form the group.³⁶ The Dutch situation bears some resemblance to an opt-out damages group action, and will be described in more detail.

³³ For an overview, see F. Stephen and J. Love, 'Regulation of the legal profession', in: B. Bouckaert and G. De Geest (Eds.), *Encyclopedia of Law and Economics. Volume III. Regulation of Contracts*, Cheltenham, Edward Elgar 2000, p. 987-1017.

³⁴ Article 47B of the Competition Act 1998. See Office of Fair Trading, 'Private Actions in Competition Law: Effective Redress for Consumers and Business', *Discussion Paper April 2007*.
< http://www.offt.gov.uk/shared_offt/reports/comp_policy/oft916.pdf>

³⁵ The proposal has met strong opposition from business pressure groups. See K. Viitanen, 'Enforcement of consumers' collective interests by regulatory agencies in the Nordic countries' in: W. van Boom and M. Loos (Eds.), *Collective Consumer Interests and How they Are Served Best in Europe. Legal aspects and Policy Issues on the Border between Private Law and Public Policy*, Groningen: Europa Law Publishing 2007.

³⁶ *Idem*.

In the Netherlands, a foundation or association with full legal capacity can institute an action intended to protect similar interests of other persons to the extent that its articles promote such interests. The organisation has standing only if it has made a sufficient attempt to achieve the objective of the action through consultations with the defendant. The organisations cannot sue for damages regarding losses of the members of the group. However, the group action can result in a declaratory decision regarding the unlawfulness of the defendants' behaviour, which can be used in subsequent individual damages procedures. Furthermore, the individual plaintiffs can authorize the organisation to collect the compensatory damages. If not all plaintiffs are traceable or if more plaintiffs are likely to turn up in the future, these solutions are inadequate from a deterrence point of view. This problem was addressed in the following way. A defendant who has entered into a contract regarding the compensation of damages with a foundation or association possessing full legal capacity, may request (jointly with the foundation or association) that the contract is declared binding by the court upon persons to whom the damage has been caused. The contract has to include a description of the group(s) of persons in whose favour the contract has been entered into, the number of persons belonging to this group, the compensation awarded to these persons (based on the group they belong to, *i.e.* damage scheduling) and the conditions with which these persons must comply to be eligible for compensation. Before it can declare the contract binding, the court has to assess the reasonableness of the amounts, the way in which the compensation can be received, whether the foundation or association is truly representative of consumers' interests and the financial security posed. If the contract is declared binding, victims will receive the agreed amount and they are bound to the contract as if they have entered into it themselves. Victims who do not want to be bound by the contract can opt-out within a certain period of at least three months after a public announcement of the intended declaration.

To some extent, the Dutch solution seems well in line with the insights from the Law and Economics literature. First, the fact that a representative organisation files the claim and enters into consultations might solve the rational apathy problem, as well as the problem that for some externalities no individuals have standing. Who should file a claim for the general deterioration of the environment or the extinction of certain species, and who can sue on behalf of future generations? Second, the court evaluates the representativeness of the organisation and the organisation has to promote the interests at stake in its articles. This limits the principal-agent problems. Furthermore, the organisation only has standing after it has tried to solve the problem through consultations. This tackles the problem of frivolous suits. Finally, in the procedure to declare the settlement contract binding, the court evaluates the settlement itself. This protects the interests of the group of victims. However, the Dutch solution requires cooperation from the defendant, because the settlement contract can only be declared binding upon a joint request from the organisation and the defendant. Absent the approval of the defendant, collective damages actions therefore are not possible in the Netherlands, and individual procedures are still needed. In as far as it is the exact threat of a damages class action that induces the defendant to settle, the Dutch system³⁷ might turn out to be a toothless lion. Another possible problem is created by the opt-out possibility, which still enables free-riding behaviour.

³⁷ However, in the Dutch *DES*-case a settlement was reached between the defendants and the representative organization, and this settlement subsequently was declared binding. See Hof Amsterdam, June 1 2006, *Nederlandse Jurisprudentie* 2006, 461.

3.5. Hybrid solutions and self-regulation

It follows from the above analysis that public enforcement may be superior to private enforcement in terms of deterrence, because public agencies have better information about the violation of safety rules and the rational apathy problem reduces the number of private damages actions below the socially optimal level. Collective actions may overcome the inefficiencies of private enforcement to some extent but cause problems of their own. This may lead to the development of 'hybrid' solutions, which combine characteristics of private enforcement and regulation with public enforcement.

To mitigate the problems of individual collective actions and representative actions by associations, these claims may be subjected to a number of conditions and limitations. Contingency fees may be prohibited and replaced by a fixed fee set by a governmental authority. To combat inadequate settlements, a preliminary test of the merits of the case³⁸ may be introduced or a judicial review of settlements may be required. However, courts may lack the information to be able to properly monitor the lawyer.³⁹ To overcome the free-rider problem, the costs of class actions could be borne by the state. Finally, to guarantee that consumer associations are really representative, a number of requirements regarding their credibility, reputability and commitment to acting in the collective interests of consumers may be fixed. Standing may be given only to consumer associations approved by a governmental body or by the courts for a particular case or cases. Furthermore, regulations may impose requirements regarding the possibilities of members to actually control the decisions of the association. In the end, all these measures boil down to a 'regulation' of private damages actions. Consequently, the differences between private enforcement and public enforcement become smaller. If public law-like rules are necessary to overcome the inefficiencies of private enforcement mechanisms, the logical question arises whether these 'hybrid' systems are preferable to enforcement by public law agencies.

Finally, the role of self-regulation should be briefly discussed. The Law and Economics literature⁴⁰ has shown that self-regulation may have a number of advantages compared to public regulation: i) self-regulatory agencies have better information about the markets to be controlled; ii) there may be a high degree of self-compliance if the rules are set by the industry itself rather than by a distant public authority; iii) self-regulation may be more flexible and more innovative; and iv) the costs of self-regulation are borne by the industries themselves. But also self-regulation is not without disadvantages: i) the rules may lack democratic legitimacy and ii) self-regulation may be abused for anti-competitive purposes. Consequently, also self-regulation must take place within an institutional framework that allows to profit from its advantages while at the same time limiting its disadvantages. In the field of safety regulation, the information advantages of self-regulation will be considerable if highly technical standards are to be set and enforced. Self-regulatory rules may fully profit from the information advantages on the side of the regulated industries and may be more easily adapted if technol-

³⁸ R. Bone and D.S. Evans, 'Class certification and the substantive merits', (51) *Duke Law Journal* 2002, p. 1251-1332; G.P. Miller, 'Review of the merits in class action certification', *ExpressO Preprint Series, Paper 262* 2004, <<http://law.bepress.com/cgi/viewcontent.cgi?article=1654&context=expresso>>.

³⁹ For an example see C. Silver, 'Class actions – Representative proceedings', 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. 215. Also see G.P. Miller, 'Class Actions', in: P. Newman (Ed.), *The New Palgrave Dictionary of Economics and the Law. Volume 1*, London: Macmillan Reference Limited 1 998, p. 259.

⁴⁰ J. Miller, 'The FTC and voluntary standards: maximizing the net benefits of self-regulation', (4) *The Cato Journal* 1985, p. 897-903; A. Ogus, 'Rethinking self-regulation', (15) *Oxford Journal of Legal Studies* 1995, p. 97-108.

ogy changes. Also, firms may more easily comply with rules enacted by the industry itself. This, in turn, may lower costs of monitoring and enforcement. On the negative side, self-regulation may create scope for regulatory capture and anti-competitive effects.

4. Timing of the enforcement measures

Enforcement measures can differ with respect to their timing. For example, tort damages by definition follow after harm has occurred, whereas injunctions avoid the occurrence of harm in the first place. Generally speaking, enforcement measures can be applied at three possible stages:

First, *preclusionary measures* take place at the earliest possible stage by directly avoiding the externality from occurring. For example, a new factory that is not meeting the required environmental standards is withheld a necessary permit so that it cannot start producing. Preclusion occurs through the use of force or physical barriers, *e.g.* the factory is locked until the problem is solved.

Second, *act-based sanctions* are applied after the norm violation, but before harm occurs or irrespective of whether it does. For example, a speeding motorist is fined, whether the speeding caused losses or not. These measures are also labelled as *input monitoring*.⁴¹

Third, *harm-based sanctions* are only applied after the occurrence of harm. Tort damages are a clear example. These sanctions are also labelled as *output monitoring*.

The legal instruments described in section 2 differ with respect to timing. As already said, tort damages are harm-based, but an injunction is a preclusionary measure. Regulation makes use of all three forms. Withholding a permit is a preclusionary measure. Issuing fines for norm violations (not having proper fire exits, restaurants having a dirty kitchen, running a shop without the proper permits, *et cetera*) are act-based sanctions. If the costs of monitoring compliance are high, harm-based sanctions might be used. The occurrence of harm can provide information on possible wrongful behaviour, so that the additional information of harm-occurrence is utilized. Criminal law also applies all three forms. Examples of act-based sanctions are traffic fines (in as far as they are not dealt with administratively) for *e.g.* speeding, drunk driving or using a mobile phone while driving. Examples of harm-based sanctions are fines or imprisonment for *e.g.* burglary, assault or homicide. Preventive detention is a preclusionary measure, and the fact that someone is detained for a previous crime also precludes him from committing other crimes. Also a recent Dutch draft bill⁴² that allows mayors and district attorneys to ban known hooligans from a certain area without interference by a court can be regarded as preclusion, if it is enforced by force. The same bill allows for criminal fines or imprisonment if the ban is neglected, which constitutes an act-based sanction.

The optimal timing of enforcement measures is determined by a multitude of factors. First, if the possible sanctions to be imposed are small (in absolute terms or relative to the benefits of the wrongful behaviour), they might not deter the unwanted act, so that preclusion is the only real option. As the magnitude of the possible sanctions increases, act-based sanctions become available, and at even higher levels also harm-based sanctions are feasible.⁴³ The possible

⁴¹ D. Wittman, 'Prior regulation versus post liability: the choice between input and output monitoring', (6) *The Journal of Legal Studies* 1977, p. 193 ff.

⁴² Approved by the Cabinet on September 7, 2007.

⁴³ Shavell 1993, *op.cit* (note 4), p. 261 ff gives a clear numerical example: a wrongful act yields 50 in benefits for the actor. The maximum sanction is 100. The act causes losses with a 20% probability. There is a 30% chance (*e.g.* due to a low probability of being caught or being convicted) that an act-based sanction will be applied and if harm occurs, there is also a 30% probability that a harm-based sanction will be applied. The

magnitude is determined by the wealth of an actor (or with imprisonment by his remaining lifetime) and is limited by notions of fairness. Furthermore, the idea of *marginal deterrence* (i.e. the sanction should vary with the size of the externalities) provides an additional limitation on the sanction. Of course, the *expected* sanction can also be raised by increasing the probability of sanctioning, but this causes additional monitoring costs.⁴⁴ In cases of terrorism where the terrorist is willing to die (e.g. suicide bombers), preclusion is the only real option. This causes high monitoring costs, such as physical safety devices at e.g. airports, phone taps, monitoring of e-mail traffic, constant surveillance of suspects, *et cetera*. The resulting invasion of privacy can be regarded as an additional cost.

Costs of monitoring and enforcement, already briefly mentioned above, are a second relevant factor. If preclusion through force or physical measures is impossible or very difficult (e.g. because it would require constant monitoring of behaviour, so that if an actor is starting a wrongful act, an official can still physically prevent it), act-based or harm-based sanctions are needed. On the other hand, if preclusion is relatively cheap (e.g., fencing an area in which actors would otherwise dump toxic waste), sanctions are less attractive. If monitoring of behaviour is difficult, preclusion and harm-based sanctions are more attractive. And if it is difficult to establish a causal relation between harm and acts, preclusion or act-based sanctions are better. Harm-based sanctions have the advantage over act-based sanctions that they have to be applied less often. In cases where it is easier to check whether regulations are obeyed than whether harm is caused (e.g. determining the level of maintenance of oil tanks in ships might be easier than detecting an oil leak into the ocean), act-based sanctions are preferable. In the opposite situation (it is easier to determine if an accident was caused by a wrong turn, than to constantly check whether all drivers make correct turns), harm-based sanctions are superior. Innes argues that monitoring the care level reduces enforcement costs relative to monitoring for harm, because if not all careless behaviour leads to harm, the rate of monitoring can decrease. This result, however, hinges upon the assumptions that in both situations, the maximum sanction is applied, and that monitoring costs for discovering harm are as high as monitoring costs of discovering norm violations. It is doubtful whether these assumptions are widely applicable.⁴⁵

expected act-based sanction then is $0.3 \cdot 100 = 30$ and the expected harm-based sanction is $0.3 \cdot 0.2 \cdot 100 = 6$. The benefits of 50 exceed both expected sanctions. Only if the sanction is higher than 166.66 (act-based) or 833.33 (harm-based) will they become effective, because only then the expected sanctions exceed 50.

⁴⁴ 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.

⁴⁵ R. Innes, 'Enforcement costs, optimal sanctions, and the choice between ex-post liability and ex-ante regulation', (24) *International Review of Law and Economics* 2004, p. 31, 32. This author provides the following numerical example: a firm can choose between no care or care (which costs 20). With care, no accident will happen. Without care, there is a 40% accident probability. If an accident occurs, harm amounts to 100. The maximum sanction is also 100. Monitoring costs (to detect careless behavior or to detect harm) equal 20. If monitoring for harm, the government chooses an optimal monitoring rate of 50%, because the expected sanction for a careless firm then equals $40\% \cdot 50\% \cdot 100 = 20$. Firms are then willing to take care, because that also costs 20. The government's average monitoring costs amount to $50\% \cdot 20 = 10$. However, if the government would monitor for care instead of harm, a monitoring rate of 20% would suffice, because a careless firm then also faces an expected sanction of $20\% \cdot 100 = 20$. Average enforcement costs drop to $20\% \cdot 20 = 4$. On pp. 40 ff., Innes discusses the possibility of free detection of accidents and argues that this free detection should be exploited as much as possible, but that for the not-freely detected accidents, the result still holds that monitoring for care is more desirable. On pp. 44 ff., Innes discusses the situation where the maximum sanction when no harm is found is lower than when harm is found. He argues that a government can threaten that if it detects a norm violation, it will then monitor for harm, to be able to pursue a higher sanction. This induces firms to take care, so that no norm violations will be found. In our view, this line of reasoning resembles the general argument in the economic analysis of tort law that optimal negligence rules deter all negligence. However, it neglects the body of literature devoted to explaining why in fact, negligent behavior does occur. See, among

Third, if the actors themselves possess good information on the dangers of their behaviour, harm-based sanctions can provide good incentives to take the appropriate care measures. If they do not know about the dangers but they do know that certain behaviour is prohibited, act-based sanctions might work fine. If the actor knows neither of both facts, only preclusion can work, provided that the public enforcement authority possesses superior information regarding the true dangers.

Changes in technology can affect the optimal timing. For example, a few decades ago the only remedy against football hooligans was to respond to them causing harm (such as injuring other spectators or damaging the seats in the stadium). Use of surveillance cameras has made it easier to detect their undesired behaviour in an early stage, before harm has been caused. Recent developments, such as using face-recognition software at the entrance of a stadium, might even avoid the known hooligans to enter the stadium in the first place. In traffic safety, the development of Intelligent Speed Adaptation opens the possibility to preclude speeding. A GPS system determines where a vehicle is located, and an onboard computer connected to a speed-limiting device makes sure that the vehicle cannot exceed the local speed limits or it warns the driver that (s)he is exceeding these limits. Furthermore, alcohol locks in cars might preclude drunk driving, so that a shift away from act-based (random alcohol tests) and harm-based (alcohol test after an accident) sanctions might occur. Finally, the use of satellites since April 2007 has dramatically increased the probability that oil spills on the ocean are detected, as compared to the use of airplanes. A next step will be the use of GPS-systems on board ships, so that it is directly clear which ship has caused the spill.

5. Centralization or decentralization

The fifth section of this paper briefly discusses the economic criteria that allow an informed choice of the most appropriate regulatory level.⁴⁶ Besides the choice of the sanctions, the choice between public and/or private enforcement and decisions on the timing of the intervention, this is an important additional policy issue in a multi-level system of territorial jurisdictions, such as the European Union. Should legal rules be decided and enforced centrally, by the European authorities, or should decisions be taken at the Member States' level (or by regional authorities within the Member States)? Some economic criteria point in favour of decision-making at lower levels of government: heterogeneity of preferences, decentralized knowledge and innovation. Other economic criteria indicate a preference for decision-making at the central level: scale economies, transaction cost savings, interstate externalities and the achievement of distributional goals. On top of these criteria, it is important to analyze the likely outcome of the different types of regulatory competition that may emerge in decentralized regulatory systems. Will regulatory competition initiate a 'race to the bottom' or will it lead to a 'race to the top'? By discussing the above criteria and analyzing the likely outcomes of regulatory competition, better informed policy choices between decentralization and centralization become possible. As it will be shown below, the weighing of the different relevant decision factors may vary across different areas of safety law.

others, Calfee and Craswell 1984, *op.cit.*, (note 9); Cooter and Ulen 2004, *op.cit.* (note 8), p. 339 ff and Shavell 2004, *op.cit.* (note 8), p. 224 ff.

⁴⁶ This section of the paper draws on the more extensive discussion of economic criteria favouring (de)centralization in: R. Van den Bergh, 'Towards an institutional legal framework for regulatory competition in Europe', (53) *Kyklos* 2000, p. 435-466 and W. Kerber, 'Interjurisdictional competition within the European Union', (23) *Fordham International Law Journal* 2000, p. 217-249.

A first major justification for decentralized decision-making is heterogeneity of preferences. A useful starting point for an economic analysis of decentralization is Tiebout's seminal article on the optimal provision of local public goods.⁴⁷ Congestible public goods, which are consumed and financed in common, do not allow people with a variety of tastes to live side by side without difficulty. People can be better off if they cluster together in communities with others who have similar tastes. If people can freely move, they can 'vote by feet' and move to the community offering their preferred bundle of public goods. Since these goods are both non-rivalrous and non-excludable, they are not supplied in sufficient quantities in free markets. Safety itself is a school book example of a public good, even though it may be privatized by offering protection only to people paying for the safety services (club goods). Also legal rules on safety have characteristics of public goods. Hence, Tiebout's theory may be extended to competition between legal rules on safety. Enterprises and citizens may have heterogeneous preferences as to their desired level of safety, which is a function of the contents of safety laws and their enforcement. The more legislators compete, the more preferences may be satisfied. Decentralization enables legislators to choose those rules which best serve the goals preferred by the local population. Firms and individuals may 'vote by feet' and choose the jurisdiction, which in their view offers the best set of laws.⁴⁸

Other economic arguments in favour of decentralized decision-making are decentralized information and learning processes. Decentralization becomes the more important the more necessary information for rule-making is available only at lower levels of government. Environmental law provides an example. Not only preferences concerning the desired degree of environmental protection differ across regions but also knowledge of pollution problems (such as information on age of plants and atmospheric conditions) may be decentralized. Hence, a preference for decentralization follows from the need to cope with informational asymmetries between regulators and regulated firms. Decentralization is the more efficient the more valuable local information is for appropriate rule making and enforcement. Besides its ability to cure informational asymmetries, decentralization carries an important and related advantage. Competition between legal orders generates all the benefits of a learning process. Differences in rules allow for different experiences and may improve an understanding of the effects of alternative legal solutions to similar problems. This advantage relates both to the formulation of the substantive rules and their enforcement. Learning may be very important to set optimal safety and health standards and strengthen the case in favour of decentralized decision-making.

Obviously, heterogeneity of preferences, decentralized information and learning processes are not the full story. Economic analysis also suggests a number of reasons in favour of centralization. Markets for legislation may fail in the same way as ordinary markets for goods or

⁴⁷ C. Tiebout, 'A pure theory of local expenditure', (64) *Journal of Political Economy* 1956, p. 416-424.

⁴⁸ As it is the case with all economic models, Tiebout's theory is valid only if a number of restrictive assumptions are satisfied:

- There must be a sufficiently large number of legislators. In the European context, twenty-seven legislators offer a relatively wide range of legal options and European law may be added as a 28th choice.
- There must be no information deficiencies. People must be able to understand the different legal rules, so that they can make well-informed choices. This is a strong assumption with respect to individuals who may face great difficulties in assessing the contents of divergent rules. In contrast, the requirement of perfect information will be more realistic for firms, which can hire experienced lawyers to assist them in shopping for the best legal regime.
- There must be no interstate externalities, no scale economies or opportunistic behaviour of legislators. As it will be further explained below, these requirements are main arguments in favour of centralized decision-making and some form of harmonization of laws.

services do not generate efficient outcomes because of market imperfections. Consequently, the need to cope with externalities between legal orders is a major argument in favour of centralized decision-making. Centralization will also generate efficiencies when extending the size of the jurisdiction allows for the achievement of scale economies and transaction cost savings. These efficiency arguments will be elaborated on below. Besides efficiency arguments, the wish to achieve a more equitable distribution of income may justify centralization. Privatization measures⁴⁹ may be criticized because they do not guarantee equal access to safety services for each citizen, irrespective of his or her income level. Corrections of the market mechanism for equity reasons are best decided at the central level.

Externalities between jurisdictions are a powerful argument in favour of centralized rule making. If allocative efficiency is to be reached in a federal state, preferences for divergent national rules in any field of law may be satisfied only to the extent that both benefits and costs remain within the jurisdiction that enacted the rules. If EC Member States enact legal rules that are likely to cause negative externalities for other Community members, centralization may be needed to guarantee that the externalities are 'internalized'. The externality problem arises in many fields: air pollution is an obvious example. The problem is more pervasive, however, and occurs in all fields of safety law discussed in this paper (tort law, regulation, criminal law). Harm caused by tortfeasors may happen in different countries and national tort laws may not guarantee a full internalization of the negative externalities occurring outside the tortfeasor's home state.⁵⁰ Also the negative effects of criminal acts in different countries may require control by a central enforcement agency.

Next, centralization may be defended because of scale economies or transaction cost savings. Scale economies may be important in the production of the information needed to formulate and/or enforce legal rules. Some information relevant to the entire European Community can be most efficiently provided by Community institutions. Uniform legal rules also maintain economies of scale in production and distribution arrangements. If diversity in safety rules prohibits firms from using the same production and marketing techniques in larger areas, scale economies may be lost. The ambitious Internal Market Programme has aimed at the removal of technical barriers caused by divergence in national regulations. The savings resulting from this removal were estimated to be substantial, although different in magnitude across industries.

Competition between legislators is often criticized because it would cause a race to the bottom. When the European Commission proposes harmonization of laws, it usually refers to the need to prevent inequality of competitive conditions across the Member States. This fear may be rephrased in economic terms as the danger of prisoners' dilemmas. States may operate, not in a market-like setting, but in a prisoners' dilemma game. When legislators can be analogized to firms selling in a competitive market, decentralized rules may be preferable. In contrast, when states compete under prisoners' dilemma conditions, national rules will produce a result that is worse than a federal rule. Regulatory laxness may occur when substantive rules have to be enacted, and also at the implementation stage. A state will only gain in the struggle to attract business by choosing in favour of laxness, when other states do not act in the same way. However, if all other states follow, only the businesses will gain. The result of this prisoners' dilemma is a race to the bottom and centralization will then be required to generate efficient outcomes. One should be careful not to overestimate the importance of the 'race to the

⁴⁹ See the discussion section 2.3 *in fine*.

⁵⁰ See R. Van den Bergh and L. Visscher, The principles of European tort law: the right path to harmonization?, (14) *European Review of Private Law* 2006, p. 518-519.

bottom' argument. Theoretically, both a race to the bottom and a race to the top may be possible. Ultimately, it is an empirical question whether regulatory competition leads to the top, to the bottom, or nowhere. So far, the empirical evidence supporting a race to the bottom in particular fields of law is limited. Therefore, the effects of competition should be analyzed very carefully before any conclusion on the desirability of either decentralization or centralization can be reached.

6. The rational choice model: limits and challenges

The rational choice model adopted in the economic analysis of law is subject to two types of criticisms. First, it is argued that criminal actors may behave irrationally, so that the goal of deterrence will not be achieved. In this respect, terrorism is advanced as a prime example. Second, the rational choice model is challenged by an alternative approach. Compliance strategies are presented as better instruments to reduce law infringements than deterrence strategies. Both points will be discussed in turn.

6.1. *Is the rational choice model useful to deter terrorism?*

Terrorism in general, and suicidal terrorism in particular, is widely seen as irrational behaviour. If this view is correct, the rational choice model would not be adequate to deter terrorist crimes. However, economists do not abandon their methodological approach that easily. They argue that the theory of optimal deterrence remains useful for policy decisions to combat terrorism, even though some adaptations of the rational choice model may be necessary to account for the peculiar preferences of particular terrorists. Caplan⁵¹ distinguishes between three classes of terrorists: sympathizers, active terrorists and suicidal terrorists. He makes a further distinction between three types of irrationality. In applied economics, rationality implies that individuals respond to incentives (by buying less goods if the price increases), that they pursue their self-interest and have rational expectations, implying that their beliefs are correct on average. Sympathizers, who favour terrorism, are rational in all three senses of the word: they respond to incentives, their behaviour is close to narrow self-interest and they mostly have rational expectations. Also active terrorists and suicidal terrorists respond to incentives. They do not assume high risks for their own sake and use riskier tactics only when they are more effective (for example, they will abandon traditional attacks if the apprehension rate is high). However, active terrorists and suicidal terrorists arguably do not match the assumptions of narrow self-interest and rational expectations. Terrorists may take self-destructive decisions and hold many systematically mistaken beliefs. Clearly, deviations from the rational choice model are greatest in the case of suicide attacks. Whereas active terrorists may be motivated by financial rewards for their families or may wish to take revenge, suicide bombers are probably self-destructive. Also, active terrorists may decide to buy less irrationality when the price rises; there are not many volunteers to commit a suicide attack. However, suicidal terrorists do not buy less irrationality when the price increases and prefer to die rather than doubt their world view. If these more refined notions of rationality are used, the conclusion is that deterrence remains a viable anti-terrorism strategy. In addition, observed deviations from rational expectations create scope for non-orthodox responses, such as propaganda or 'cheap talk' and appeasement or 'cheap action'. Irrational persons may be persuaded by rhetorically targeting feelings rather than facts. If cheap concessions may neutralize a dangerous world view, appeasement may be a cheap way to reduce terrorism.⁵²

⁵¹ B. Caplan, 'Terrorism: the relevance of the rational choice model', (128) *Public Choice* 2006, p. 91-107.

⁵² *Idem*, 102-104

Garoupa, Klick and Parisi have carried out a Law and Economics analysis of optimal enforcement regarding terrorism. In as far as terrorists respond to the incentives provided by criminal law, it is argued that the sanctions should be relatively severe, due to the often large externality that is caused, the relative low apprehension rates and the fact that terrorists on average are wealthier than other categories of criminals.⁵³ If terrorists do not care about possible imprisonment or even death penalty, increasing the probability and/or magnitude of the sanction will have no effect. Under such circumstances, as it is likely the case with suicidal terrorists, it might be better to target the terrorist organization, e.g. by freezing bank accounts and confiscate property, so that the terrorists are cut off from their funds.⁵⁴ Furthermore, the authors argue that the group or family to whom the (potential) terrorist belongs might be targeted with group liability, because the group members are better able to monitor and control the terrorist.⁵⁵ This can obviously work only if the group or family is not supporting the terrorist, or if it is susceptible to the threat of possible sanctions imposed on the group. Individuals within the group or family who are uninformed about the activities might become informed about this when they are faced with group liability, and they might therefore increase monitoring efforts in the future to avoid additional wrongdoing.⁵⁶ Finally, the fact that terrorists are often part of an organization makes it possible to target incentives at other individuals within the organization. The terrorist may not care about imprisonment, but the people who provide financial support might. Also, the fact that terrorist acts often involve more than one individual enables to create distrust by instruments such as plea-bargaining, or leniency programs for ‘whistleblowers’.⁵⁷

6.2. Compliance strategies as an alternative to deterrence strategies

It must be noted that deterrence strategies based on the rational choice model is not the only possible approach to improve the enforcement of safety norms. Instead of deterring actors from norm violations by the use of sanctions, it is also possible to try to induce them to comply with the applicable norms by informing them about the norms, giving advice how to adapt to the norms, giving warnings instead of applying sanctions when violations are observed and only revert to sanctions if the other approaches yield no success. This approach is known as compliance strategies. Burby and Paterson argue that compliance strategies are better where regulations are adopted to achieve performance standards, while deterrence strategies are superior in obtaining compliance with specification standards as well as in situations where the costs of compliance clearly outweigh any direct benefits to the actor involved.⁵⁸ Suurmond has analyzed the compliance approach regarding Dutch fire safety regulation.⁵⁹ The research was conducted on the basis of visits to and interviews with thirteen municipalities’ enforcement officials. Suurmond concludes that the scope for compliance strategies is rather limited and that a shift towards a more deterrent enforcement strategy is desirable.

⁵³ N. Garoupa, J. Klick and F. Parisi, ‘A law and economics perspective on terrorism’, (128) *Public Choice* 2006, p. 156.

⁵⁴ *Idem*, p. 148.

⁵⁵ *Idem*, p. 149.

⁵⁶ *Idem*, p. 152.

⁵⁷ *Idem*, p. 155.

⁵⁸ R.J. Burby and R.G. Paterson, ‘Improving compliance with state environmental regulations’, (12) *Journal of Policy Analysis and Management* 1993, p. 765, 766.

⁵⁹ G. Suurmond, ‘Compliance to fire safety regulation: explaining the influence of the enforcement style’, *Paper for the 24th Annual Conference of the European Association in Law and Economics in Frederiksberg, Denmark 2007*, < www.cbs.dk/content/download/67268/930124/file/Guido%20Suurmond.pdf >.

Nyborg and Telle have executed a game theoretical analysis of the enforcement of Norwegian environmental regulation. After a norm violation is detected, firms receive a warning and they only face prosecution if they fail to comply after the warning. Why would a violator comply in the first place, if he knows that he will get a second chance anyway? Would a deterrence approach not provide stronger incentives to comply? According to the authors, the regulator's ability to impose sanctions on individual violators is decreasing with the number of violators, due to constraints on the budget for prosecution costs. The same line of reasoning holds for the social disapproval connected to norm breaking. Once the number of violators exceeds a critical level, the sanction becomes insufficient to deter violations.⁶⁰ Below this critical level, all firms want to comply. Above it, all firms want to violate. The regulator 'loses control' if more than the critical number of firms, either deliberately or by mistake, violates the norms.⁶¹ A warning to a firm that mistakenly violates the norms, instead of sanctioning it, can be seen as a device that reduces the probability of losing control. After all, a firm that by mistake violates the norms can correct its behaviour, so that after the warning fewer firms violate than without the warning. The probability that the critical number of violating firms is reached therefore decreases. However, this result only holds under the assumption of compliance consisting of fixed costs that have to be spent per time period, and of positive verification costs imposed on those who only comply after the warning. Under those assumptions, it is never cheaper for firms to reduce their costs by simply delaying compliance until after having received a warning. However, if compliance can easily be 'switched on and off' with no or low costs, or if net verification costs are negative so that it actually pays to delay compliance, warnings might not help. Furthermore, if the detection probabilities are small, the conclusions also do not hold.⁶² In our view, many of the violations that Suurmond discusses are exactly of this last nature. In the case of fire safety regulation, it is relatively easy to switch compliance on and off (removing tables or beer crates from the fire exit before the inspection and putting them back after the inspection, not allowing too many people in the establishment, being careful with candles, ash-trays, and so on), the probability of detection is relatively low (the inspections are announced or even take place on appointment, and only once or twice a year) and costs can be saved by waiting with compliance until after a warning is given (for example, postponing the costs of annual certification of fire extinguishers).

7. Conclusions

The risk society faces an increasing demand for more safety and security but government resources are inevitably limited both with respect to the enactment of new substantive legal rules on safety and the enforcement of these rules. An economic approach provides useful insights on how dangerous acts may be avoided and on the optimal level of law enforcement. Three basic policy decisions must be made: the choice of the sanction, the choice between public and/or private enforcement and the timing of the enforcement measures. An additional choice in a (quasi-) federal system relates to the optimal government level of enforcement: should enforcement measures be decided centrally or at lower levels of government (decentralization)? By using the rational choice model, economic analysis provides useful insights for improving the quality of the policy choices to be made.

⁶⁰ K. Nyborg and K. Telle, 'The role of warnings in regulation: keeping control with less punishment', (88) *Journal of Public Economics* 2004, p. 2802, 2803.

⁶¹ *Idem*, p. 2808.

⁶² *Idem*, p. 2813.

A lack of adequate safety measures causes negative externalities to society at large. These externalities may be internalized by different legal instruments, which use different types of sanctions.

Tort law imposes injunctions or forces wrongdoers to pay damage compensation; regulation makes use of administrative fines; criminal law allows the imposition of criminal fines and the sanction of imprisonment. Optimal enforcement measures in each of these categories will reduce the number and severity of violations of safety rules. A rule of strict liability minimizes the accident costs by providing incentives to adopt efficient care measures and choose an optimal activity level. A negligence rule minimizes accident costs by providing incentives to choose efficient care, provided that courts set the level of due care equal to efficient care. In a unilateral accident situation (where the victim has no impact on the expected losses), a rule of strict liability is superior since it also provides incentives to optimally decrease the level of dangerous activities. It is important to stress that efficient outcomes will be reached only if damages equal the size of the actual losses (strict liability) or are sufficiently high to induce optimal care (negligence). In this respect, three problems emerge. First, the probability of a 'conviction' (duty to pay compensation) may be too low due to uncertainty and rational apathy. Punitive damages may mitigate this problem. Second, tortfeasors may be 'judgment proof'. If their assets are lower than the size of the losses, vicarious liability of principals may be considered but monitoring costs of this solution may be high. Third, immaterial losses (pain and suffering, loss of life) tend to remain undercompensated.

Compared to sanctions under tort law, administrative fines are imposed *ex ante* before the occurrence of harm; they are also more flexible since their size must not equal the magnitude of the loss. Regulation is superior to tort law if the government has better information than private parties and the judge. Regulation also allows achieving scale economies. Conversely, regulation may suffer from shortcomings if its contents are determined by pressure groups, and decision-makers are victims of regulatory capture.

Criminal sanctions should provide incentives to minimize the total costs of crimes. These consist of the negative externalities thrown upon society minus the gains to the offenders, the costs of apprehension and conviction, the supply of crimes (which is dependent on the probability and severity of the sanctions) and the costs of punishment. A major advantage of criminal fines is their greater deterrent effect. Imprisonment also offers a solution for the judgment proof problem, even though it should remain an exceptional sanction (principle of marginal deterrence).

Tort law, regulation and criminal law all differ with respect to the costs of formulating safety rules and the enforcement costs of their sanctions. Tort law is relatively cheap: use may be made of open norms that need to be specified only *ex post* if harm occurs and monitoring costs are low. Conversely, regulation entails higher costs of formulating norms. Regulation also carries the risk of inconsistencies and monitoring costs tend to be high, because of controls that take place *ex ante*. Finally, enforcement costs are highest under criminal law. This is due in particular to the costs of imprisonment and the damage caused by judicial errors that need to be prevented by means of special safeguards.

Economic analysis also provides criteria to enable an informed choice between public and private enforcement. Optimal private enforcement requires that private parties possess perfect information on the occurrence and seriousness of law infringements and that the private interest to sue in court coincides with the social interest in preventing infringements. Public enforcement will be a superior strategy if public enforcement agencies have an information advantage over private parties and when the private motives to bring suits are not identical with the social benefits of court proceedings. The challenge for policy makers is to design an op-

timal mix of public and private enforcement. In a typical tort case, victims have sufficient information on the occurrence and the size of the harm. This may be different in case of violation of safety norms that are more difficult to discover and assess. In the latter case, the private motive to bring suit may be insufficient because of rational apathy and the free-riding problem. Collective actions and/or representative actions may (partly) overcome the above problems but pose difficulties of their own.

With respect to the timing of the enforcement measures, a distinction can be made between preclusionary measures, act-based sanctions and harm-based sanctions. The first category includes preventive detention or the withholding of permits for exercising dangerous activities. Fines imposed before harm occurs or irrespective of whether it does are act-based and can be characterized as a form of input monitoring. Damages are a harm-based sanction that may be seen as a form of output monitoring. Different factors have an impact on the choice of the most timely sanction: the size of the sanctions, the costs of monitoring and enforcement and the information on risks. The following examples illustrate these insights. If small act-based or harm-based sanctions do not sufficiently deter, preclusion may be the only option. If it is easier to check whether regulations are obeyed than whether harm is caused, act-based sanctions are preferable. If actors are sufficiently aware of dangers, harm-based sanctions may be considered.

Economic analysis is also useful to inform the debate about the most appropriate level for decision-making and enforcement measures in a multilevel system of jurisdictions. Heterogeneous preferences concerning safety, decentralized information about safety levels and learning processes are major arguments in favour of decentralization. Conversely, the need to internalize negative interjurisdictional externalities, the achievement of scale economies and the risk of a race to the bottom may justify centralization.

This paper also paid some attention to the limits and the challenges of the rational choice model. Using the example of terrorism, it is often questioned whether criminal actors behave rationally. To counter this criticism a distinction must be made between different classes of terrorists and different types of irrationality. Generally, the rational choice model remains useful even though subject to some adaptations. Moreover, sanctions may be targeted also at organizations or groups. The rational choice model is further challenged by an alternative model of compliance strategies. It is often argued that enforcement efforts may be more successful if use is made of a 'soft' approach relying on information of infringers and persuading them to obey safety rules. Game theory shows that warnings are not effective if compliance can be 'switched on and off' or if it pays to delay compliance. The Dutch case of fire safety regulation provides some empirical support for these theoretical predictions.