

Liability for Unknown Risks: A Law and Economics Perspective

Michael Faure, Louis Visscher and Franziska Weber

I Introduction

Liability for unknown risks is a difficult topic, not only for legal scholars but also in Law and Economics.¹ The reason is, in essence, simple: a lack of information about the risks involved. The Law and Economics of tort law centers on the incentives that tort law can provide to the various actors in order to take better decisions regarding their level of care and level of activity, and in order to reach a desirable risk distribution. However, how does liability for risks which are not known at the time of acting affect the behavior of the parties involved? Can liability for such unknown risks give better incentives for optimal behavior, or will it by definition lead to excessive care and a too low activity level? These and comparable questions will be discussed in this contribution.

When analyzing liability for unknown risks from an economic perspective, it will become apparent that in a sense we are approaching the boundaries of what tort law can accomplish. This opens a subsequent important question: should unknown risks be dealt with via tort law in the first place, or is public regulation better suited to deal with this challenge? The Law and Economics literature, more specifically literature on the topic of *optimal enforcement*, compares and contrasts tort law and regulation as two ways to deal with the problem of ‘negative externalities’. These are costs which are not borne by the persons who have caused them, but by others. The archetypical example is environmental pollution: if during the production process eg the air is polluted, it is the people who breathe that air who bear these costs, not the producers or consumers. The product price hence does not capture all the costs the production imposes on society, so that it is too cheap, and too much will be produced and consumed. Various legal instruments can result in internalization of the externality, such as taxes (eg per tonne of emission), criminal law (financial penalties for environmental crimes), but also regulation (which eg requires certain filters to be installed) and tort liability (where the victims can claim tort damages from the polluter). Regarding the topic of unknown risks, it is an important question whether tort law or regulation can better steer the behaviour of the parties involved in the desirable direction. Issues such as the available information (for regulation the information of the legislator, for tort liability the information of plaintiffs, defendants and courts), issues of enforcement (public versus private), administrative costs and the influence of interest groups are relevant here.

In this contribution we will provide a short introduction into the economic analysis of tort liability and regulation (Section II) as two distinct ways of dealing with the market failure of negative externalities. In Section III we will discuss tort liability for unknown risks in more detail and we will analyze the way in which such liability may impact the incentives

¹ In this article we use the term ‘unknown risks’ as a synonym of ‘unknown dangers’. The term ‘risk’ hence does not intend to express that there is statistical information available about the probability distribution of the various possible outcomes. ‘Risk’ in this latter sense in the literature is confronted with the term ‘uncertainty’, where the probability distribution of the outcomes is not known. In fact, the case of ‘unknown risks’ will often be a situation of uncertainty rather than of risk. We chose to use the term ‘unknown risks’ nonetheless, because this is the topic of the Special Session of the 15th Annual Conference on European Tort and Insurance Law. See eg *FH Knight, Risk, Uncertainty, and Profit* (1921).

provided by tort law. This section will show that there are several effects that can be distinguished, and that tradeoffs between these effects are unavoidable. It turns out not to be possible to give a definite answer whether liability for unknown risks is desirable and if so to what extent; it depends on the situation. What *is* possible in our view is to make generalizing remarks on this trade-off, which enables to distinguish between types of cases. The difficulties of tort law in dealing with unknown risks are reasons to investigate whether public regulation might be a preferable approach and if yes, under which conditions. We will do this in Section IV. In that section we will more particularly pay attention to the question whether either the regulator or the judge is better placed to deal with unknown risks. Unknown risks may also pose serious problems for insurers as knowledge concerning risks is usually considered a primary condition for insurability. Hence, we will also address to what extent liability for unknown risks may cause insurability problems (Section V). In Section VI we will conclude.

II Liability and Regulation from an Economic Point of View – A Summary

As a starting point and as a theoretical foundation for the analysis of liability for unknown risks we will first explain the basic economics of torts and of optimal law enforcement, whereby also the main differences between tort and regulation will be highlighted. At a later stage this will be applied to the specific case of unknown risks.

A Basic Economic Function of Tort Law

Liability and regulation become relevant from a Law and Economics' point of view once a market failure is established. The primary market failure experienced in tort law consists of a negative externality. The basic idea is that by exposing tortfeasors to the social costs of their activity, they will have *ex ante* incentives to take optimal preventive measures. This perspective reasons from the angle of the deterrence function of tort law that induces compliant behaviour by potential tortfeasors in the sense that they take optimal care, which is the primary function for an economic analysis.² Optimal care is defined as the level of care where the marginal costs of taking more care equal the marginal benefits thereof (in the sense of a reduction in the expected accident losses). In addition to taking optimal care the parties involved in an accident setting should also be provided incentives to choose an optimal activity level.³

The second crucial function of tort law is that of victim compensation.⁴ In the deterrence framework, expected liability matters to the potential tortfeasor *ex ante*.⁵ (Potential) tortfeasors are regarded as rational utility maximisers, and therefore weigh possible benefits against the costs of their behaviour. Like anyone else, they respond to incentives. The effect of deterrence in the tort law setting translates into (potential) tortfeasors taking optimal care and carrying out the activity at the optimal level.

B Strict Liability versus Negligence

² See *R Cooter/T Ulen*, *Law & economics*, (5th edn 2008) 336-338.

³ See *S Shavell*, *Foundations of economic analysis of law* (2004), 193-199.

⁴ For the goals of tort law, for instance, see *D Rosenberg*, *Decoupling Deterrence and Compensation Functions in Mass Tort Class Actions for Future Loss* (2002) 88 *Virginia Law Review* 1871.

⁵ *Shavell* (fn 3) 515.

From an economic perspective, the main goal of tort law is to provide behavioural incentives to the actors involved. Within tort law, more specifically one distinguishes negligence-based and strict liability regimes⁶ and between unilateral (where only the tortfeasor affects the accident probability) and bilateral cases (where also the victim impacts the accident probability).⁷

In the unilateral scenario, both strict liability and negligence induce the tortfeasor to take optimal care, provided that the court sets the level of due care at the socially optimal level. Regarding the activity level, under negligence an injurer would escape liability if he took due care, no matter how often he carried out an activity and will consequently choose a too high activity level. In case of strict liability the tortfeasor chooses the optimal activity level, because he bears both the benefits and the costs of this activity. Turning to the bilateral scenario, pure strict liability leads to no care and an excessive activity level for the victim, because he does not bear any costs. The injurer will choose excessive care and a suboptimal activity level (assuming care and activity inputs of both players are substitutes). A defense of contributory negligence can provide correct care incentives to the victim.⁸ Alternatively, a negligence rule provides good care incentives to both parties, if the court sets due care at the optimal level. However, only the party that ultimately bears the accident losses will choose the correct activity level.

C Liability versus Regulation

With a view to the interplay between liability and regulation, in his seminal paper Shavell determines how risky activities should be controlled on the basis of four key parameters.⁹ First, an information advantage of the public authority over private parties or vice versa. This would make one of the options more attractive. The second aspect concerns whether there is an insolvency risk with the defendants. If they were facing a private liability suit that was beyond their assets, they could not be deterred fully. On the other hand, in the regulatory context, they would have needed to comply with certain standards in order to be allowed to carry out the activity in the first place. A third aspect concerns the question whether the responsible parties would face a suit for the harm done in court at all. Reasons for why this may not be the case in Shavell's words are dispersed harm, a long lapse of time before harm eventuates and difficulties in attributing the harm to the responsible party. More commonly these days one focuses on the rational victim's cost benefit analysis. She will not act if costs outweigh the benefits, for instance when harm is very small and the investment to enforce the law is costly.¹⁰ This is the so-called 'rational apathy'. Total harm to society may be large, but if it is widespread it may be small per victim. No enforcement action may then be taken

⁶ See eg *H-B Schäfer/F Müller-Langer*, Strict liability versus negligence, in: M Faure (ed), Tort law and Economics, Vol. 1 Encyclopedia of Law and Economics (2nd edn 2009).

⁷ *Shavell* (fn 3) 177-206.

⁸ See *LT Visscher*, Tort Damages, in: M Faure (ed), Tort Law and Economics, Vol. 1, Encyclopedia of Law and Economics (2nd edn. 2009), 156–158 and 173-174 f.

⁹ See *S Shavell*, Liability for harm versus regulation of safety (1984) 13 *Journal of Legal Studies (JLS)* 357. Also see *CD Kolstad/TS Ulen/GV Johnson*, Ex Post Liability for Harm vs Ex Ante Safety Regulation: Substitutes or Complements? (1990) 80 *American Economic Review* 888.

¹⁰ See *RJ Van den Bergh*, Should Consumer Protection Laws Be Publicly Enforced?, in: W van Boom/M Loos (eds.), *Collective enforcement of consumer law: securing compliance in Europe through private group action and public authority intervention* (2007), 184.

because of a divergence between the individual and social incentive to sue.¹¹ This harms society and reduces incentives to comply. Lastly, as has been stressed by Shavell, one of the strengths of the private liability system is that it only incurs costs whenever a case is brought. Regulation will always lead to costs. Safety regulation (enforced through administrative law) would work to a large extent ex ante and would not be triggered by harm and could therefore potentially lead to high costs.¹² This assessment varies with the type of cases at hand. The ex ante dimension may not always be more important than the ex post dimension if, for instance, a lot of compliance checks have to be carried out. The main costs with public enforcement occur in the form of monitoring and investigation, particularly, the use of investigative powers.¹³

With a view to remedies, civil liability typically results in compensation payments. In stark contrast to civil litigation the benefits for individuals involved in an administrative procedure usually do not include compensation.¹⁴ The possibility of obtaining compensation is typically an important motivation for claimants.¹⁵ Public agencies traditionally have remedies like injunctions, revocation of licenses or fines at their disposition. If the authority works on the basis of giving out permits, by checking that companies fulfill the necessary requirements, harm may not occur in the first place.

III Liability for Unknown Risks

A Introduction

The economic approach to law assumes that the actors can assess the costs and benefits of care, because their care and activity decisions depend on how they weigh these costs and benefits. In case of unknown risks, this weighing process might not result in optimal decisions, because some of the costs that are relevant for a correct weighing, are not (yet) known. The important question of course is: do we want injurers to be held liable for unknown risks? In order to answer this question from an economic perspective, we have to compare the behavioural incentives in case of possible liability for unknown risks with those where liability for such risks is not possible. Several aspects are relevant here, which are discussed below. We will discuss both situations where a risk is unknown according to the state of the art (so the scientific and technical knowledge) and situations where a risk was known according to the state of the art but not to the individual injurer. The question in the latter case is whether an injurer should be able to escape liability for risks which were known in science, but which were not known to him. In this respect, issues such as information costs and benefits are relevant and one can indeed imagine that there are situations in which the costs for an injurer to become informed about certain risks (which are known according to the state of the art) outweigh the benefits (of being able to adapt the behavior to this new information and thereby avoiding liability claims). We will return to both issues in our detailed discussion.

¹¹ See WM Landes/RA Posner, *The Private Enforcement of Law* (1975) 4 JLS 1, 33.

¹² See Shavell (1984) 13 JLS 357.

¹³ See D Wittman, *Prior regulation versus post liability: The choice between input and output monitoring* (1977) 6 JLS 193, 207.

¹⁴ However, in some cases the individual can use the outcome of the administrative law enforcement in a subsequent private law suit.

¹⁵ See S Shavell, *The optimal structure of law enforcement* (1993) 36 JLE 255, 267: other incentives for an individual are the desire to avoid future harm, the retributive motive, and possibly a fear of reprisal.

B Effects of missing information

1) Care level

If a certain risk is not known according to the state of the art at the time a potential injurer acts, will liability for such risks affect the care level taken by the injurer? Schäfer and Ott argue that this will *not* be the case, because one cannot base care decisions on things one does not know. Because the risks were not known according to the state of the art, even with a higher level of care the risks would still be unknown. Lowering the probability of such unknown risks cannot be achieved with taking more care, because one does not know the risks in the first place.¹⁶ Calabresi and Klevorick however argue that liability for unknown risks *can* affect the care level.¹⁷ In their comparison of, roughly speaking, negligence where only information at the time of acting is used and negligence where information at the time of the trial is used, they state that the uncertainty inherent in the latter case can result in both excessive care and inadequate care.¹⁸ In that sense, different than Schäfer and Ott, they speak of two different types of negligence standards. Taking more care may reduce the chance of being found negligent, which could give an incentive to take socially excessive care. After all, the private benefits of taking more care (possibly escaping liability altogether) outweigh the social benefits (lowering the expected accident losses).¹⁹ On the other hand, as Calfee and Craswell argue, the new information might also show that the behavior was less risky than thought *ex ante*, which might induce potential tortfeasors to take *less* care. This last issue, however, is not relevant for the topic of liability for unknown risks.

2) Activity level

Ott and Schäfer argue, comparably to their line of reasoning regarding the care level, that unknown risks cannot provide relevant information for improving one's activity level. After all, one does not know whether such risks exist and, therefore, one does not know how much expected accident losses they might entail. Hence, one cannot base optimal activity decisions on them. However, fear for liability for unknown risks might induce actors to withdraw from the activity altogether. In as far as the activity was socially desirable, this would cause inefficiencies.²⁰ An important element to take into consideration in the analysis is that many activities that could create unknown risks, such as for example genetically modified organisms (GMOs), particular pharmaceuticals or instruments in the fight against climate change (like carbon capture and storage) do not only create risks, but they may have beneficial aspects for society as well. Those beneficial aspects are referred to as positive externalities. The goal of tort law is to not only deter the potential harm resulting from

¹⁶ *H-B Schäfer/C Ott*, Lehrbuch der ökonomischen Analyse des Zivilrechts (2012) pp. 239. However, they add that there are restrictions to this statement: society also has an interest to develop institutions that make it worthwhile to invest in research to find out whether seemingly harmless activities could nevertheless still have potential for damage. In that case liability would provide incentives to tortfeasors to do the necessary research to find out the potential of danger.

¹⁷ *G Calabresi/AK Klevorick*, Four Tests for Liability in Torts (1985) 14 JLS 585, 619. Also see *MF Grady*, Causation and foreseeability, in: J Arlen (ed), Research Handbook on the Economics of Torts (2013), 133.

¹⁸ Also see *JE Calfee/R Craswell*, Some Effects of Uncertainty on Compliance With Legal Standards (1984) 70 Va.L.Rev. 965, to which Calabresi and Klevorick refer.

¹⁹ Also see *O Ben-Shahar*, Should Products Liability Be Based on Hindsight? (1998) 14 JLEO, 325-326.

²⁰ *Schäfer/Ott* (fn 16) 240.

(unknown) risks (negative externalities) but equally to promote and protect those benefits (positive externalities) to society as well.²¹ If tort law would expand to such an extent that activity levels would be reduced, there is a danger that the positive externalities would be lost to society as well.

C Incentive to do research

Given that the general existence of unknown risks is acknowledged, in a next step one should ask if incentives can be tuned in a way to find out more about these risks.²² The question arises whether an actor, if she would be shielded from liability because she was exercising due care in the light of the available knowledge to her, would still have incentives to investigate further to obtain more information concerning potential risks. It may be obvious that, especially under the application of the negligence rule, as we will argue below, this incentive to do this further research might be diluted if the applicable standard of care would only be based on the available knowledge at the time of acting.

Liability for unknown risks can induce the potential injurer to do more research, in order to find out if there are more risks than are currently known.²³ Liability for unknown risks can hence push the state of the art forward, provided that the potential tortfeasor is indeed able to do such research (or hire others to do so).²⁴ Finsinger and Simon write in this respect, when analyzing the development risk defense from the field of product liability: ‘History teaches that it are the firms who first collect hints, and then acquire evidence of such risks. (...) Producers first learn about development risks.’²⁵

‘Potential tortfeasors also need to be provided with incentives to inform themselves about the state of the art. The objective here is not pushing the state of the art forward, but ensuring that the state of the art is common knowledge among the operators and can, hence, serve as a baseline for the behavioural standards that liability is imposed upon.

The literature which discusses the possible effect of liability for unknown risks on the incentives to obtain information, distinguishes between strict liability and negligence. In both cases, the assumption is that without doing additional research, the potential tortfeasor bases his care and activity decisions on his current assessment of risk. Shavell labels this care level as ‘moderate’ care.²⁶ If the additional research reveals that the behavior is more risky than originally thought, the potential tortfeasor can increase his care level and reduce his activity level, because those levels turn out to be preferable over the previous average care level. If the research reveals that the behavior is *less* risky than originally thought, the opposite holds.

1) Strict liability

In deciding whether or not to do additional research, the potential injurer assesses the probability that his behaviour is more or less dangerous than currently known. Doing

²¹ See *I Gilead*, Tort law and internalization: the gap between private loss and social costs (1997) 17 IRLE 589.

²² *Schäfer/Ott* (fn 16), 240.

²³ See especially *S Shavell*, Liability and the Incentive to Obtain Information About Risk (1992) 21 JLS 259.

²⁴ *Schäfer/Ott* (fn 16) 240..

²⁵ *J Finsinger/J Simon*, An Economic Assessment of the EC Product Liability Directive and the Product Liability Law of the Federal Republic of Germany, in: M Faure/R Van den Bergh (eds), *Essays in Law and Economics* (1989), 196.

²⁶ *Shavell* (1992) 21 JLS 259, 260.

research yields two expected benefits:

1. A reduction in total accident costs (which consist of the costs of care plus the expected accident losses at that level of care) caused by a lower care level if the activity turns out to be less dangerous, multiplied by the probability that the activity indeed turns out to be less dangerous;
2. A reduction in the total accident costs caused by a higher care level in case the activity turns out to be more dangerous, multiplied by the probability that the activity indeed turns out to be more dangerous.

If these expected benefits outweigh the costs of research, the actor will engage in research. This is a socially desirable decision, because with strict liability there is no difference between private benefits and social benefits: the injurer bears all costs and receives all benefits of additional research. Because the private and social benefits of care are the same, the actor takes socially desirable decisions. Hence, he only does additional research if this is socially desirable.

2) Negligence

If negligence means that an injurer can only be liable if he took too little care, *given optimal collection of information*, also negligence can result in socially desirable behavior.

- Let us first assume that the information costs outweigh the sum of benefits (1) and (2) mentioned above, so that research is not required and moderate care is socially optimal. An injurer who does not obtain more information will indeed take moderate care, which is desirable. In this setting, tort law will indeed not induce the injurer to obtain additional information. The private benefits of doing research only consist of a possible decrease in care costs if the activity turns out to be less dangerous. Benefit (2) however does not exist at all because moderate care was already enough to escape liability. Hence, the private benefits are lower than the social benefits, and the social benefits were already assumed to be lower than the costs of additional research.
- Let us now assume that the information costs are smaller than the sum of benefits (1) and (2), so that it *is* socially desirable to do research. An actor who indeed does additional research, will adapt his care level to the information he found and hence will act socially desirably. Tort law will induce the injurer to always indeed obtain this additional information. After all, if he would not do research, he would still have to decide on which care level to choose: high care, or a lower care level:
 - In case he would decide to take a lower care level, he would choose moderate care, because that is the best he can do if he does not have more information. Because we assumed that the social benefits of doing research outweighed the costs of research, and because under negligence the *private* benefits of doing research (escaping liability altogether) are larger than the social benefits ('merely' reducing the total costs of accidents), the injurer is always incentivized to do the research.
 - In case he would choose high care, private benefit (2) would not exist because the injurer already takes high care. Private benefit (1) however is now very large, because it consists of the difference in care costs between high and low care. It can be mathematically proven that this private benefit outweighs the information

costs, so that here as well, the injurer decides to obtain additional information.²⁷

If negligence, to the contrary, means that the injurer can only be held liable if he took too little care, *given the information he possessed*, the injurer might not get adequate incentives to obtain information. If he acquires more information and finds out that his activity is less dangerous than previously thought, he can reduce his care level, which provides a private benefit and on a social level also still is desirable (the reduction in care costs outweighs the increase in expected accident losses due to this lower level of care). But if he finds out that his behaviour is more dangerous than previously thought, he has to increase his care level. This is socially desirable (because the decrease in expected accident losses outweighs the increase in care costs), but entails a private cost (the higher care costs). Hence, the private benefits of information are lower than the social benefits of information. This implies that there can be situations where the social benefits of information may outweigh the information costs, but the private benefits do not. Potential injurers in such settings are not incentivised to do adequate research.

3) Conclusion and application to product liability scenario

In order to provide potential injurers with desirable incentives to obtain information, one should not look at what the injurer *knew*, but at what he *should have known*. This line of reasoning is relevant for the evaluation of the state-of-the-art defense, where an injurer in essence argues that he did not know the risk and did not have to know it, because it was not known according to the state of the scientific and technical knowledge. This is, for instance, a prominent discussion with a view to product liability law. Due to a political compromise as it stands product liability operates on the European level under a regime of strict liability for defective products, however, subject to a ‘development risk defense’. The European Union Product Liability Directive explicitly excludes liability with the ‘development risk defense’ provided for in Article 7(e) of the directive, which protects the producer from liability if she can prove that the state of scientific and technical knowledge at the time when the product was put into circulation was not such as to enable the existence of the defect to be discovered, ie, signaling a preference for the opposite of development risks liability.²⁸ Article 15(1)(b) does provide an option for Member States to introduce liability for development risks;²⁹ however this option has only been taken up to date by Luxembourg and Finland.³⁰ These are hence the only countries which accept liability for development risks. One can discuss if the reluctance to apply development risks liability may lead to inefficiencies and may reduce the incentives for producers to reduce the risk of products where they are able to do so in a cost effective manner.³¹ Schäfer and Ott are against imposing liability for development risks altogether because unknown risks cannot be

²⁷ *Shavell* (1992) 21 JLS 259, 266.

²⁸ *Id.* at art. 7(e); See also *J Boyd/DE Ingberman*, Should “Relative Safety” be a Test of Product Liability? (1997) 26 JLS 433, explaining that the ‘customary practice test’ tends to induce inadequate safety, whereas the ‘technological advancement test’ tends to induce excessive safety.

²⁹ See generally Council Directive 85/374, art.15, 1985 O.J. (L 210) (EC) (responsibilities of Member States).

³⁰ *HC Taschner*, Harmonization of Product Liability Law in the European Community (1999), 34 *Tex.Int.L.J.* 21, 32. It has also been adopted by Spain, for food and medicinal products, and by France for products derived from the human body. See Commission of the European Communities, Green Paper Liability for Defective Products 34-35 (1999).

³¹ *MG Faure/MEA Goodwin/F Weber*, The regulator's dilemma: caught between the need for flexibility & the demands of foreseeability. Reassessing the *lex certa* principle (2014) 24 *Albany Law Journal of Science & Technology* 283, 356.

considered in such a calculation exercise.³² However, they acknowledge that incentives to do research can only be given via a liability. Either way the case may be different with new technologies that are *prima facie* cases of risky activities. ‘‘

From an economic perspective, such a defense should only be accepted if the costs of doing additional research outweigh the expected benefits thereof. As was argued above, under negligence such a defense avoids that actors do more research than is desirable, and under strict liability the actor already has the correct incentives to only do research if the benefits outweigh the costs.

This implies that a state-of-the-art defense should not always be accepted: there can be situations in which a risk is not part of the state of the art, but additional research by the injurer would have entailed lower costs than benefits. This is especially relevant in situations where the injurer might possess specific information and experience. On the other hand, it is also conceivable that certain risks are known in science, but that the costs of the injurer of becoming informed about these risks outweigh the benefits. In such situations, even though the risk was known in science, one still could reach the conclusion that *this* tortfeasor did not have to know this risk, and hence that liability is not warranted to make it profitable for him to engage in the activity.

In the above-explained line of reasoning, probabilities played an important role, and here one still has to decide whether one only regards the possibilities as they were assessed at the time of the act, or at the time of trial. . If one uses *ex ante* probabilities, a situation might occur in terms of which too little research will be done and a too low care level will be chosen, as compared to the information at the time of trial. At that later time, it could turn out that more research and/or more care would have been desirable.³³ On the other hand, if one uses *ex post* probabilities, the actor might be incentivized to do too much research (in order to avoid liability in the future) and to take too much care (as was already explained in Section 3.2.1 above). Which approach is better depends on which results in a more desirable outcome. This cannot be determined in abstract terms.

D Innovation

Besides doing more research in order to investigate whether unknown risks exist, potential injurers (especially if they are manufacturers) may also try to innovate, in the sense of developing new products and techniques. The two perspectives may to some extent be interlinked. If firms in this way improve upon existing products and techniques, innovation is stimulated with positive effects for social welfare as a result. However, it is also possible that liability for unknown risks does not stimulate innovation, but actually hinders it. Fear of liability for possible hidden risks in these new products may result in

³² Schäfer/Ott (fn 16) 385; T Cosack Die Gefährdungshaftung im Vordringen - Hintergründe und ... Versicherungsrecht (1992), VersR , 1439, 1441. Also see Fondazione Rosselli, Final Report ‘Analysis of the Economic Impact of the Development Risk Clause as provided by Directive 85/374/EEC on Liability for Defective Products’ (2004) 36.

³³ Ben-Shahar (1998) 14 JLEO 325, 346 argues that even when using *ex ante* knowledge, there might still be an incentive to do research, because this research might reveal that the activity is less dangerous than originally thought. If the research reveals more risks, the injurer might try to keep that information secret. This last step differs from the analysis of Shavell explained above, according to which such information would result in the injurer having to take more care.

firms not developing such new products. This could hence result in less innovation.³⁴ The firms might prefer trying to limit the familiar risks of existing products over developing new products which might suffer from unknown risks.³⁵ Landes and Posner argue that liability for unknown risks will induce the manufacturer to actively invest in technologies that increase the safety of their products, rather than waiting to see if such new information will become available over time.³⁶

Huber has argued that under liability for unknown risks, manufacturers will not market a product which might suffer from unknown risks.³⁷ This statement reveals another important insight. It is desirable if the product indeed suffers from inefficient risks, but it is undesirable if the introduction of socially desirable new products or techniques is delayed or frustrated altogether.³⁸ One proxy of assessing how many unknown risks might be out there with a view to a certain product is the degree to which details about a product are known. Even if a new product would actually be safer than the old one, fear of liability for unknown risks might result in not marketing this new product but rather accepting liability for the known old risks.³⁹ Whether liability for unknown risks is desirable then depends on what is more important: avoiding the marketing of products which are not (yet) safe enough, or not hindering the introduction of better new products.

E Conclusion

It is not possible to give a clear answer to the question whether liability for unknown risks is socially desirable, and if so in the form of which regime. If such liability results in more care, this could be excessive, but not having liability for unknown risks could result in too little care. The same holds for the activity level, although fully stopping the activity will often constitute a too low activity level (unless it indeed suffers from unknown risks and does not yield much benefits). Liability for unknown risks induces actors to obtain more information about risks. If ex post information is used to determine the standard of due care, the incentives to do research might be excessive, but when using ex ante information, the opposite problem may occur. Innovation is also affected: it may be stimulated in order to make the products safer, or it may be hindered because manufacturers are afraid of marketing new products with possible unknown risks. In the field of pharmaceutical products, possible liability for unknown risks seems to have a limiting effect. Depending on the true characteristics of the product, this effect is socially desirable or undesirable. The overall effect of liability for unknown risks on administrative costs is unclear: there may be more tort claims, but the individual claims are less complicated.

It is possible to make some generalizing statements nonetheless. In as far as the activity involved serves a more important social goal (eg new medicines to combat eg cancer), hindering introduction and innovation comes at higher social costs, due to the likely delay in introduction. For such situations, liability for unknown risks should be used cautiously. One might even conclude that for certain unknown risks, society at large should

³⁴ Schäfer/Ott (fn 16) 386. Also see Fondazione Roselli (fn 32) 51ff.

³⁵ See eg *JW Wade*, On the Effect in Product Liability of Knowledge Unavailable Prior to Marketing (1983) 58 NYU L.Rev 734, 755.

³⁶ *WM Landes/RA Posner*, A Positive Economic Analysis of Products Liability (1985) 14 JLS 535, 555.

³⁷ *P Huber*, Safety and the Second Best: The Hazards of Public Risk Management in the Courts (1985) 85 Col.L.Rev., 277, 308.

³⁸ See eg *Wade* (1983) 58 NYU L.Rev. 734, 755.

³⁹ *Huber* (1985) 85 Col.L.Rev. 277, 308. This issue is especially relevant for the introduction of vaccines, which might suffer from unknown side-effects.

bear the costs rather than the individual operator. This can be achieved by eg letting the state bear the costs of such risks. Cooter and Ulen provide an interesting illustration of this: manufacturers of a vaccine against swine flu were only willing to market the vaccines after the federal government agreed to be the exclusive defendant in any actions for harms arising from the swine flu vaccine.⁴⁰ One could also think of systems where research ‘fishing’ for unknown risks should be carried out by society rather than by operators to avoid large societal losses. The calculation would, after all, depend on the magnitude of the societal loss due to an unknown risk.

Another general conclusion is that the easier it is for a potential injurer to acquire information, the more knowledge we should expect of him. This implies that ‘what the injurer should have known’ might differ per type of injurer. Some of them do not have to be familiar with the state of scientific and technical knowledge, while others might even be expected to know more than that.

What also has become clear, is that it is very difficult, if not impossible, to use tort law as an instrument to provide the socially optimal incentives if unknown risks are involved. This opens the question whether alternatives to tort law might be better suited to achieve this goal. In Section 4 we will analyse the potential of regulation from this perspective.

IV The regulator versus the courts

In section 2 we already discussed the optimal enforcement theory arguing that from the perspective of the theory of Shavell, under certain circumstances regulation may be a preferred instrument compared to the tort system.⁴¹ One of the criteria advanced by Shavell was the information available to parties (for regulation the information of the legislator and for tort liability the information of plaintiffs, defendants and courts). We will apply this general framework to the case of unknown risks and argue that since operators may (by definition) lack information on unknown risks there could be a priority for safety regulation. This follows from what is often referred to as a public interest theory of safety regulation (A). However, a difficulty with this argument is that it supposes that the risks are not unknown in absolute terms, but unknown to operators, whereas they could be knowable to regulators. That, however, may not always be the case and hence not an absolute argument to merely rely on safety regulation. Under the circumstances sketched in section 3 there may still be room for liability as a complement to safety regulation (B). Moreover, dependent upon the danger of capture with the regulator versus the expertise of the courts it may be possible to look for smart mixes, combining regulation and liability rules to deal in an optimal way with unknown risks (C).

A Priority for safety regulation?

Initially we differentiated between the case where a risk is not known to the operator because its existence is not yet part of the state of the art yet and the case where it is not known to the operator despite being part of the state of the art. Now, obviously it is challenging to identify the information level with a view to different operators. A public regulator is generally speaking privileged when it comes to information gathering compared to private individuals. When information becomes highly technical or scientific, a public authority might be better

⁴⁰ Cooter/Ulen (fn 2) 363.

⁴¹ See Shavell (1984) 13 JLS 357.

equipped to gather or produce it.⁴² The advantage of a regulator is that it could make use of economies of scale. This implies that research into the consequences of new activities and the risks involved would only have to be carried out once by a regulator who could subsequently pass on the obtained information via regulation instead of having the situation where each separate operator would have to undertake the research separately. This seems to make a case for the fact that a public regulator would be in a better position to obtain information about the state of the art. . Under strict liability it would be the operator who would need to do the research; under negligence it would be the judge who would have to fix the optimal care standard. Both operators and judges may be in a less advantageous position compared to the regulator to undertake the research aimed at obtaining information, however.

Entrusting a regulator to issue safety regulation, hence, seems to dramatically reduce the likelihood that an operator miscalculates his care level because he was not aware of a certain risk which according to the state of the art was widely dispersed knowledge as could happen with a strict liability regime. At the same time, obviously an error produced at a central level obviously affects any operator. With a negligence regime the question becomes whether the judge accurately sets the negligence standard – by way of considering all the risk information available. By involving expert witnesses in court procedures (eg agency personnel) this may effectively be the case. In the public sphere one can think of a system that works via the operation of licenses, for instance. Here, relevant is the authority carrying out regular check-ups as to whether an operator's facilities comply with the standards imposed by the safety regulation.

As illustrated in section 3, it is possible to give operators some incentives to gather information on newly emerged risks (and thereby cause them to adapt their care and activity level) depending on the liability system. Hence, it is not exclusively possible to erode lack of knowledge on the side of the operators with a view to risks that form part of the state of the art via shifting to safety regulation but it is to a significant extent possible by certain designs of liability law. This can also be achieved by way of fine-tuning whether a state of the art defense exists and under which conditions, incentives for the operator to become informed can be generated. Leaving strict liability aside, the question boils down to whether the judge or the authority is in a better position to assess the liability standard (by having gotten hold of all new information). As said, one can think of experts appearing in court procedures, a scenario that may be anticipated by the operators when deciding on the care/activity level. Overall a central authority may be privileged in the sense that it can gather information in a low cost way.

What about the case of a risk not yet known according to the state of the art? As illustrated in section 3 to advance the state of the art – and thus, innovation – incentives are again necessary and similarly operators need to be incentivised to do research with a view to identifying new risks. Obviously incentives to innovate are not only stimulated by the tort system but also crucially by patent law. Is a public authority again privileged? One would typically expect experts (operators) to be more easily able to identify potentially new and up to date unknown risks given their proximity with the production processes. Therefore, those incentives need to be set into motion. It is more unlikely that a public agency would research new risks – even though it might depend a bit on the personnel structure of the agency – but some studies could well be commissioned by a public authority. It is even more unheard of

⁴² See *Shavell* (fn 15) 270; *C Hood/H Rothstein/R Baldwin*, *The Government of Risk: Understanding Risk Regulation Regimes* (2001), 73.

that public authorities would be the ones to innovate with a view to new products. Complying with safety regulation shields operators from liability similar to operating at the optimal care level as induced by a negligence standard. Strict liability works differently. The public authority, hence, needs operators as an information source. Otherwise the safety regulation may be ill-suited. A differentiation may be warranted as to where information costs to the individual operator are high vs. low. In the latter case the operator can be entrusted to research, whereas in the case of 'high information cost' (compared to the private benefits) one may have to look for a more centralised solution. Of course, the challenge is to know which context will involve high or low information costs *ex ante*.

The regulatory system has undoubtedly its own weaknesses as well. Information gathering and standard setting via regulation is relatively costly. Also regulation only works well when there is (public) enforcement which will equally be costly.

B Searching for smart mixes

The foregoing suggests that there is scope of complementarity for liability law and regulations generally and also more particularly in the context of 'unknown risks'. Generally, arguing along the four steps that Shavell suggests, the following conclusions can be drawn: A public regulator generally profits from an information advantage. Specialised knowledge is necessary in the context of safety regulation, for its formulation and during compliance checks. At the same time, experts from the authorities may also be able to intervene in court proceedings, providing expert advice. One has to distinguish between different forms that information can have – as illustrated the crucial differentiation is whether information is out there according to the state of the art but not known to some operators or goes beyond the state of art. In the latter contingency the incentives of the operators are key. The liability systems generate important incentive effects. Incentives to innovate should likewise not be neglected. The negligence rule can, as said, generate public information about the state of the art. The negligence rule could possibly be fruitfully combined with regulatory oversight where the regulator collects and shares this information.

The insolvency risk of the tortfeasor is also labelled the problem of the 'judgment-proof wrongdoer'. As to insolvency, law and economics literature argues that private law generally provides only purely monetary sanctions that cannot sufficiently deter a judgment-proof offender.⁴³ This is generally true. However, a civil law injunction is different because the prospect thereof can be a powerful deterrent for an operator.⁴⁴ With mass damage cases regarding previously 'unknown risks', like the BSE scandal, one can easily imagine how compensation claims would surmount a tortfeasor's assets.⁴⁵ Regarding insolvent wrongdoers, Shavell points us to regulatory enforcement because parties need to comply in

⁴³ *Shavell* (fn 3) 473. An insolvent trader cannot be deterred by purely monetary sanctions. In practice, this is where insurances and funds come into play. In contract law, the judgment-proof problem is mitigated, according to *Shavell* (fn 3) 586, as people tend to know about each other.

⁴⁴ See *MG Faure/AI Ogus/NJ Philipsen*, Curbing Consumer Financial Losses: The Economics of Regulatory Enforcement (2009) 31 *Law & Policy* 161, 176; *AI Ogus/LT Visscher*, A Law and Economics Perspective on Injunctive Relief (2010) 17 *Maastricht Journal of European and Comparative Law*, 32.

⁴⁵ The potential insolvency is obviously an important argument in favour of mandatory solvency guarantees, such as insurance. See in that respect inter alia *P Jost*, Limited liability and the requirement to purchase insurance (1996) 16 *IRLE* 259 and *MG Faure*, Economic Criteria for Compulsory Insurance (2006) 31 *The Geneva Papers on Risk and Insurance* 149.

order to be able to engage in a certain activity.⁴⁶ This is certainly the case if a product's access to the market is otherwise barred. The food sector, however, does for instance not fully work according to this principle. A responsibility is also placed on businesses to assess if their products are compliant for large parts of the food industry. This means that they may, however, also commit regulatory breaches and we would again need to look at the sanctioning mechanisms. Also administrative law makes use primarily of monetary sanctions, like fines. However, sanctions such as license revocation available to a public agency might be more effective with regard to a judgment-proof wrongdoer.⁴⁷ Here, an important advantage lies with criminal law enforcement as the system has various available sanctions including non-monetary penalties, primarily imprisonment, that serve to remedy the issue of a judgment-proof defendant.⁴⁸ Imprisonment is essential as a deterrent⁴⁹ and is the desirable sanction when the probability of detection and conviction is low and the likelihood of defendants being judgment-proof is high.⁵⁰ The danger of over-deterrence and operators withdrawing from a certain product market altogether has to be considered as well when imposing extensive liability for 'unknown risks' however. So, whereas public law enforcement scores better than private law enforcement regarding the judgment proof-wrongdoer, it is really only criminal law that may provide for deterrence in all cases.

There are some potential incentive problems regarding the rational expectation that a case will be initiated in the civil court and successfully litigated. The problem of rational apathy has been referred to. Additionally, one can mention the free-riding problem. We can imagine a situation in which many victims suffer from a law infringement but all gain as soon as one of them complains. For each individual it is beneficial to wait for someone else to institute a case and then profit from the result.⁵¹ Again a socially desirable action may not happen. We can see how this is clearly interrelated with the remedy sought. One can again think of designs of group litigation that reduce the free-riding mentality in terms of which strictly only those who contribute to the proceedings are allowed to profit from them.⁵² They might likewise help to reduce rational apathy. Public law enforcement may, likewise, be a cure to many of these problems. Deterrence and as a consequence an adjustment of the care and activity level and a decision on which information to research does obviously not work if liability cannot be expected. In such a situation it may be warranted for the public agency to ensure compliance with its safety regulation. The issue of incentives with a view to possible litigants are a problem in any enforcement context. With regards to damages due to 'unknown risks' one can imagine both – scenarios with large, some as minor and widespread damage. The threat of a lawsuit might by purely relying on the liability system hence not always be imminent.

The advantage of civil litigation is that (most of the) costs are only incurred whenever an actual case is litigated. A regulatory approach leads, on the other hand, to constant administrative costs. Identifying the costs in detail is challenging. These costs are particularly

⁴⁶ See *Shavell* (1984) 13 JLS 357, 361.

⁴⁷ See *Faure/Ogus/Philipsen* (2009) 31 Law & Policy 161, 178 expand on the issue of licenses and how this can possibly have a greater deterrent effect for traders than imprisonment.

⁴⁸ See *R Bowles/M Faure/N Garoupa*, *The Scope of Criminal Law and Criminal Sanctions: An Economic View and Policy Implications* (2008) 35 Journal of Law and Society 389, 402; *S Shavell*, *Criminal Law and the Optimal Use of Nonmonetary Sanctions as a Deterrent* (1985) 85 Col.L.Rev. 1232, 1247; *Shavell* (fn 3) 544.

⁴⁹ *Shavell* (fn 3) 532.

⁵⁰ See *Bowles/Faure/Garoupa* (2008) 35 Journal of Law and Society 389, 405.

⁵¹ See *Landes/Posner* (1975) 4 JLS 1, 29.

⁵² See *RJ Van den Bergh*, *Private Enforcement of European Competition Law and the Persisting Collective Action Problem* (2013) 20 Maastricht Journal of European and Comparative Law 12, 14.

high if a lot of responsibilities are placed on the public authority to carry out (ex ante) checks. They can be reduced if responsibility is placed upon the operators in the market. In this case, non-compliance with the regulation triggers an enforcement response just as liability rules do. Hence, again (to a large extent) costs in these scenarios only occur once there are reasons to expect non-compliance. With a view to newly discovered risks one can imagine how safety regulation is constantly being updated. With a view to the negligence standard, this new information would have to be incorporated via the court system.

General liability for unknown risks avoids having to answer the question which risks the injurer could and should have known. It simplifies the procedure and therefore reduce administrative costs. The same holds for the fact that the information at the time of the trial is used, rather than information at the time of the act, which might be decades ago. It is therefore easier to set the behavioural standard. On the other hand, liability for unknown risks might result in more tort suits, because it is now also possible to hold someone liable for losses caused by risks which were not known at the time of the act. This results in higher administrative costs. The total effect cannot be predicted theoretically and depends on the size of both sub-effects. The more new risks that are discovered over time and the easier it is to assess the ex ante due care level, the more likely it is that liability for unknown risks results in increased administrative costs.

The outcome provides a mixed pictures and leads to the conclusion that aiding the key public players by some supplementary private law enforcement may be warranted. The guideline with a view to the possible incentive effects of the liability system was developed in section 3.

C A Private Interest Approach

Yet another argument can be advanced in favour of a ‘smart mix’ between tort law and regulation. So far we assumed that public regulation, as the name suggests, is made by public officials in the public interest. However, public choice theory has powerfully pointed at the fact that incentives of bureaucrats may be diluted as a result of capturing by interest groups. This danger may also play out when unknown risks could emerge, for example from GMOs, pharmaceutical products or geo-engineering. Successful lobbying and seeking by private interest groups may prevent regulators from undertaking precisely from the necessary research into the state of the art. There is, moreover, the risk of capture at the level of enforcement as well.⁵³ As such, taking into account the predictions from public choice theory concerning the likely success of interest groups there is a large likelihood that special interest may prevail at the level of regulation. Olson predicted that special interest groups would be successful if the transaction cost for the group would be relatively low and if the information cost for the public would be high.⁵⁴ Usually the groups (such as the pharmaceutical industry) concerned are well-organised and have relatively low transaction costs. The information cost for the public at large to discover that adequate research into unknown risk is not undertaken by the regulator because of lobbying by interest groups may be very high. Becker indicates that if a countervailing power (for example by non-governmental organisations or consumer groups representing the interest of potential victims) exists, there is a likelihood that competition between different interest groups will emerge, as a result of which the

⁵³ See *AI Ogus*, Regulation: legal form and economic theory (1994) 57. For the food sector more specifically, see *S Henson/J Caswell*, Food safety regulation: an overview of contemporary issues (1999) 24 Food Policy 589.

⁵⁴ *M Olson*, The logic of collective action (1965).

regulation may still come close to an efficient result.⁵⁵ However, in the case of the activities which could involve unknown risks there is again a danger that this countervailing power is not present. As a result there is a serious danger that the public regulator may, as a result of the influence of private interest, not take sufficient efforts to invest in disclosing unknown risks. Again, various remedies may be applied to ensure that the interest of the regulator is better aligned with the public interest. Regulation to separate competences either by different entities or different units may be warranted,⁵⁶ and the possibility of appeals and reviews (as generally provided for in administrative procedural law) may reduce the occurrence of this risk. Another measure is the case selection procedure and ways to challenge the refusal to investigate of the entity. Also for this reason a mix of regulation with supplementary private law enforcement may be warranted. The mix may serve as a disciplining mechanism, still exposing tortfeasors (especially under a strict liability regime) still to liability, even when regulation (as a result of the involvement of private interest) would fail.

Lastly, having in mind a resource-saving enforcement approach, making use of some self-regulatory techniques may also be desirable. One of the presumed advantages of self-regulation is that it generates better information (since operators – experts – would be better informed than bureaucrats).⁵⁷ Thus such a system would, given the information advantage, be able to solve cases of non-compliance at lower costs than a court system or a system relying purely on public regulation. Moreover, such a system is often privately financed (by industry), which may have substantial advantages in providing incentives for cost reduction.⁵⁸ Then again, the risk of capture is embedded in self-regulation. According to some authors, self-regulation runs the risk of being the ‘ultimate form’ of regulatory capture, as there is obviously a tight link to the industry.⁵⁹ It may be crucial for governments to play an ‘active role’ in monitoring self-regulatory activities.⁶⁰ Self-regulatory entities enforcing codes of conducts are also typically much more limited in their sanctioning powers. Again an interlinkage with other, more powerful, enforcers is crucial to incentivise compliance with self-regulatory schemes. Such schemes will not work with businesses operating in the food market that do not care about their reputation as they exert very limited binding power.

V Insurance for unknown risk

The concept of insurance for unknown risks sounds a bit like a paradox. One of the key

⁵⁵ *GS Becker*, A theory of competition among pressure groups for political influence (1983) 89 *Quarterly Journal of Economics* 371.

⁵⁶ See *F Cafaggi/H-W Micklitz*, Administrative and Judicial Enforcement in Consumer Protection: The Way Forward, in: F Cafaggi/H-W Micklitz (eds), *New Frontiers of Consumer Protection – The Interplay Between Private and Public Enforcement* (2009), 406: ‘In theory the use of public agencies to monitor and directly sanction would seem to be more effective than separating administrative monitoring from judicial enforcement. But especially in relation to cooperative enforcement, when the enforcer has to conclude agreements with the infringer, the resort to an independent judiciary may ensure transparency and reduce capture. Thus the higher the use of cooperative enforcement, the more necessary it is to resort to separation between monitoring and enforcement.’

⁵⁷ See on the advantages of self-regulation inter alia *AI Ogus*, *Rethinking Self-Regulation* (1995) 15 *Oxford JLS* 97.

⁵⁸ On the other hand, the payment structure can make a case for introducing regulation against biased decision-making.

⁵⁹ See *FH Stephen/JH Love*, Regulation of the Legal Profession, in: B Bouckaert/G De Geest (eds), *Encyclopedia of Law and Economics, Volume III: The Regulation of Contracts* (2000) 990.

⁶⁰ See *JC Miller III*, *The FTC and Voluntary Standards: Maximizing the Net Benefits of Self-Regulation* (1985) 4 *Cato Journal* 897, 903.

features of insurance, as has often been held in the literature, is that insurers make calculations of the probability that a certain event may occur, either based on statistics (which are in turn based on past loss experience) or based on modelling (predicting the occurrence of the risk in the future). However, the basis for any type of insurance is that a risk has to some extent to be predictable in order to be insurable. Factual and legal uncertainty are considered factors that endanger this insurability. When risks would indeed be totally unknown, predictability and hence insurability would be problematic.⁶¹ However, it is paradoxical that in practice insurers may cover (even unknowingly) unknown risk, for example when they provide a general liability cover to enterprises. Moreover, it can be held that exactly where risks are unknown the risk aversion of operators may be high and hence also the demand for protection via insurance. That hence raises the question whether there are ways of dealing with unknown risk from an insurability perspective. We will first address predictability as a general condition for insurability, but also point to the concept of ‘ambiguity aversion’ by insurers and techniques that have been used to reduce this aversion (A). Next, the question will be addressed whether particular solutions could be envisaged to deal with the unknown character of particular risks (B). The question for example arises whether the unknown character of a risk should be considered more problematic in the context of a third party (liability) insurance or in the context of a first party insurance. Moreover, in the literature it has been suggested that risk-sharing between operators might be preferable in situations of uncertainty since risk-sharing is possible without an assignment of probabilities. Finally the question arises how the potential liability of operators for unknown risks should be viewed from an insurability perspective (C). This question has been addressed under the heading of ‘retrospective liability’, whereby operators would be held liable for risks which they could not foresee *ex ante*. There is hence a clear parallel with the liability for unknown risks discussed in the previous section. Such a retrospective liability is, so we will argue, often problematic from an insurance perspective.

A Predictability

1) General

The essence of an insurance scheme is that the insurer will, based on *ex ante* information concerning a particular risk, engage in risk assessment and on that basis calculate the objective value of the risk leading to a so-called actuarial fair premium. It may be clear that in that respect unknown risks constitute a serious problem.⁶² A crucial element in insurance in order to make an accurate premium calculation possible is to have precise information on the probability that a certain loss will occur and the insurer should have a more or less accurate estimate of the potential magnitude of the damage. The predictability, necessary to calculate the premiums (and to set aside a reserve necessary to have money available when the risk materializes) is usually based on the past loss history of a particular risk and thus on statistics. Statistics may, precisely given the unknown character of the risk, be lacking. But the same problem may arise with respect to the second possibility to calculate premiums, namely, to engage in a risk assessment on the basis of modelling. If the risk would be entirely unknown, such a modelling would obviously be impossible as well. However, it may be clear that this representation is a too black and white presentation. After all, if risks were unknown *ex*

⁶¹ This regards the difference between ‘risk’ and ‘uncertainty’ we referred to in footnote 1.

⁶² Also see Fondazione Roselli (fn 32), 69ff.

ante there would equally be no demand for insurance. After all, why would an insured demand cover for particular risks that cannot be known yet? The answer lies to some extent in the fact that often, especially under liability insurance, insurers may provide rather general coverage, for example, eg for operational risks of all different kinds and may hence not be aware of unknown risks that would be related to a particular insured.

2) Insurer Ambiguity

It has been indicated in the literature that the mere fact that there is uncertainty concerning particular risks, for example resulting from the absence of reliable statistics, should not necessarily lead to the conclusion that a particular risk is uninsurable. This uncertainty is referred to as 'insurer ambiguity'.⁶³ It is held that the insurer can react to this ambiguity concerning either the probability of the event or the magnitude of the damage by charging a so-called risk premium to account for a particular unpredictability. In practice insurers could hence, when they fear that in a general (for example liability) cover some unknown risks would be involved, try to some extent deal with that risk by charging an additional risk premium. The extent to which insurers are able to actually charge this additional premium of course also depends upon the comparative environment in which the insurer finds himself.

However, there may be other solutions or remedies enabling insurers to deal with unknown risks.

B Potential solutions

1) First party versus third party insurance

Generally a distinction is made between two types of insurance: liability insurance is a third party insurance whereby the insurer covers the risk that the insured (the potentially responsible operator) would have to provide compensation to a third party. First party insurance to the contrary is a system whereby the insurance coverage is provided and compensation is awarded directly to the victim. The underlying principle in first party insurance is that the insurance undertaking in principle pays as soon as the damage occurs, provided that it can be proven that the particular damage has been caused by the insured risk. Payment by the insurance undertaking therefore occurs irrespective of whether there is liability. The literature has strongly argued in favour of first party insurance, arguing that it would lead to lower transaction costs and that it would make risk differentiation substantially easier.⁶⁴ The reason is that with first party insurance the insurer directly covers the risk of damage to a particular victim or to a particular site. This may hence be less vulnerable to the emergence of new risks. Liability insurance involves many more uncertainties, for example related to how the judge will interpret the specific liability of the insured operator. In an ideal world under first party insurance risk differentiation would also be easier as it allows the insurer to directly monitor the behaviour of the insured risk, namely, the insured victim.⁶⁵ Although obviously unknown risks may equally pose a problem for first party insurance one

⁶³ See *H Kunreuther/R Hogarth/J Mezaros*, Insurer ambiguity and market failure (1993), 7 *Journal of Risk and Uncertainty* 71.

⁶⁴ See in that respect more particularly *G Priest*, The current insurance crisis and modern tort law (1987) 96 *Yale Law Journal* 1521.

⁶⁵ See for example also *W Bishop*, The contract-tort boundary and the economics of insurance (1983) 12 *JLS* 241.

could generally hold that greater use of first party insurances would probably lead to less problems than the use of third party liability insurance when unknown risks are involved.

2) Risk-sharing agreements

An alternative to insurance is a risk-sharing (also referred to as risk distribution or risk pooling) between plant operators. It consists of an agreement whereby operators ex ante agree to mutually share each other's losses. Skogh has indicated in several publications that risk pooling has a few advantages compared to insurance, especially in case of uncertainty (as with unknown risks). Risk-sharing between operators does not necessarily require the ex ante payment of a premium. Mutual risk-sharing can be based on an agreement to share losses ex post but does not require actuarial information on the risk ex ante.⁶⁶ It is only necessary that the relative contribution to the risk of the various operators is known, so that they can agree on their mutual share. Given the unknown character of the risk, risk distribution could even be based on a proportional share, eg related to the size of the operator involved. Mutual risk-sharing could therefore be an option if unknown risks are involved and hence precise actuarial information on the predictability of the risk is lacking.

It is therefore no surprise that especially in areas of catastrophic risks, such as marine pollution or nuclear risks, risk pooling between operators is used to a large extent. Risk-sharing between operators is also advocated for new technologies that could involve unknown risks, such as for the case of carbon capture and storage.⁶⁷ Risk-sharing between operators could hence provide an interesting alternative for particular activities where unknown risks may be involved. However, one should realise that risk-sharing equally entails particular administrative costs and that it usually emerges between operators that have comparable risk profiles as a result of which administrative costs can be kept relatively low. Risk-sharing agreements may hence not be a viable alternative for all situations where unknown risks would emerge.

C Retrospective liability

One issue for against which the literature has warned is for a so-called retrospective liability. It does not so much concern liability for unknown risks, but rather the situation where there was initially no liability for particular risks but because of due to a change in the scope of liability rules, liability is ex post expanded ex post to a domain for which the insured is still held liable. Obviously there is a thin line between the liability for unknown risk on the one hand and the situation where a care or liability standard changes and as a result liability is created. In fact there have been many situations examples of this in various legal systems, for example, concerning asbestos or the drug DES where it was held that it was not foreseeable for operators, nor for their insurers that these type of activities would give rise to liability.⁶⁸ It can certainly be held that such a retrospective liability, ie where only after the fact, ex post

⁶⁶ See *G Skogh*, Development risks, strict liability and the insurability of industrial hazards (1998) 23 Geneva Papers on Risk and Insurance 247; *G Skogh*, Insurance Coverage of Accidental Damage, in: H-B Schäfer et al (eds), *Konsequenzen wirtschaftsrechtlicher Normen* (2002) 428ff.

⁶⁷ See for details *M Faure*, Liability and compensation for damage resulting from CO2 storage sites (2016) 40 *William & Mary Environmental Law and Policy Review* 454.

⁶⁸ Whether these statements are absolutely correct is of course another issue.

liability is created is problematic from an insurance perspective.⁶⁹ The problem is that if insurers are held liable ex post for risks which could not be foreseen ex ante when the insurance contract was concluded, no additional premium has been charged for the particular risk, that no preventive measures could be demanded and that also no reserves have been set aside. I Again, it is one issue to generally provide general liability cover and another to , also cover for risks that are technically still unknown. In the latter case liability insurers may be aware of the fact that they partially provide cover for as yet unknown risks related to the activity of the operator and they could, given this situation of insurer ambiguity, charge an additional risk premium. The situation envisaged here is that it would not be foreseeable at all for an insurer that a particular risk would give rise to liability and that it is not a new risk which appears in the future, but rather a change of the legal rule or liability standard which leads to the duty on the operator and hence on the insurer to compensate of the operator and hence of the insurer. The latter situation, often referred to as retrospective liability, is undesirable since it could indeed amount to an insurability.⁷⁰

VI Concluding remarks

We started by explaining that from the Law and Economics perspective that we presented in this contribution, liability for unknown risks may be problematic. The simple reason is that a starting point of the economic analysis of accident law is that operators are exposed to liability risks which will hence provide them incentives for taking optimal care and for adopting optimal activity levels. If it is assumed that these risks are unknown to the operator it will obviously become impossible to have those incentive effects directly related to care and activity levels. However, the crucial question is whether a liability for unknown risks can induce a potential tortfeasor to do more research in order to find out more about the risks which could be related to his activity. In that respect we argued that a strict liability rule may have the major advantage that it shifts the entire accidents costs (both the costs of prevention as well as the expected damage) to the injurer. As a result of that the potential injurer will engage in an optimal weighing of the marginal costs of investing more in versus the marginal benefits in obtaining more information about the risks. We argued that the situation with negligence is slightly more complicated, depending upon the precise interpretation of the standard of care under the applicable negligence rule. If negligence would imply that an operator would not be held liable since he took the optimal care level on the basis of the information he possessed the problem may be that this may does not provide sufficient incentives for investing in optimal research to find information about those unknown risks. It is therefore clear that care standards, also under negligence, have to be interpreted in a dynamic manner in order to be adapted to increasing insights that render previously unknown risks known. However, a problem is that care standards under negligence are set by the court, which may by definition have less information on risks than the operator. That is an important argument in favour of primarily using ex ante safety regulation to discover unknown risks. Regulators may have better information than judges (if a negligence standard is applied in tort law) but in some cases also than operators (under strict liability). Regulation moreover has the advantage that it can use economies of scale and pass on information on new risks via safety regulation. However, safety regulation has important limits as well. One

⁶⁹ See in this respect inter alia *K Abraham*, Environmental liability and the limits of insurance (1988) 88 Columbia L Rev 957ff and *R Zeckhauser*, Nineteenth annual lecture of the Geneva Association and Catastrophes (1996) 21 Geneva Papers on Risk and Insurance 5 (arguing that retrospective liability may affect the predictability of risks).

⁷⁰ See also *M Faure/T Hartlief*, Insurance and expanding systemic risks (2003) 124-125.

important limit being that regulation is not only created in the public interest, but in particular cases in the private interest. The intervention of private interest may lead to reduced incentives of agencies to acquire information about unknown risks. That is one important reason (in addition to other limitations inherent in the public safety standard setting) in favour of a search for so-called 'smart mixes', implying that safety regulation should be combined with liability rules. More particularly since the negligence standard is dependent upon the definition of an ex ante determined standard of care safety regulation could fulfill that task.

Finally we indicated that unknown risks may also constitute a serious problem for insurers. Unknown risks do not make risks necessarily uninsurable as long as insurers are aware of the fact that they may be covering risks that are not known yet. Theoretically first party insurance would be better able to deal with those uncertainties than third party liability insurance. However, it is possible that equally in a third party liability setting insurers have provided broad general liability cover as a result of which future unknown risks may automatically be included. That is not necessarily a problem as long as the insurer can incorporate this unknown risk by, for example, charging an additional risk premium in order to deal with the ambiguity aversion of the insurer. Also, in particular cases risk-sharing agreements may be more practicable than insurance since risk-sharing has the major advantage that it does not need the ex ante precise assignment of probabilities with respect to risk. However, although risk-sharing agreements are gaining increasing popularity, they may not be feasible for all types of risks. We concluded by formulating a particular warning for the case where liability is not related to unknown risks, but where it is rather the liability risk that was unknown ex ante, a situation referred to as retrospective liability. It is for this particular case that we argued that uninsurability might arise as a result of which we held that the policy maker should avoid this to in as far as possible.