Liability and climate change

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Michael Faure, Maastricht University, Public Law and Marjan Peeters, Maastricht University, Public Law

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Summary

In view of the need to curb greenhouse gases, the question arises as to the functions of liability in providing effective incentives for emitters in order to change their behavior. Liability for emitting greenhouse gases exists (or can exist) in the area of public law and private law and can be subdivided into international, administrative, and criminal liability (public law liabilities) and tort law liability (private law liability). Actions for holding individual and legal persons (such as states, authorities, and companies) liable can, depending on the specific jurisdiction, be triggered by citizens but also by legal persons, such as authorities, companies, and non-governmental organizations (NGOs), particularly environmental NGOs. The central question in this article is how climate liability is arranged under public law and whether there would be any role for climate liability to play under private law, thereby applying a legal and economic methodology. That so-called law and economics doctrine is a useful approach as it has given a lot of attention, for example, to the different functions of specific legal instruments (more particularly regulation, including taxation and emissions trading and tort law liability) for mitigating greenhouse gases. Meanwhile, in practice, various examples can be identified whereby tort law liability is used as a complement to greenhouse gas regulation. This specific use of tort liability is analyzed in the light of the law and economics literature, thereby pointing at prospects but also at remaining core questions. The success of tort law actions will most likely greatly depend on the (lack of) ambition vested into the emissions regulations at international and national levels. One of the exciting questions for the near future is to what extent judges feel able to step into the regulation of the climate change problem, in an ex ante way. The most difficult cases are obviously those where a regulatory system concerning greenhouse gas mitigation has been put in place and where the court system is strong, but where particular groups consider the regulations to be insufficient.

Keywords: regulation, greenhouse gas emissions, tort law, liability, litigation, private interest, public interest, public choice, public law, emissions trading

Subjects: Policy, Politics, and Governance

Introduction

While greenhouse gas emissions are still on the rise (International Energy Agency, 2018),[1] the question of whether liability law can help to curb this trend in order to bring down emissions to a safe level is one of the core themes of current climate law. This article aims to provide major insights into this issue, thereby taking liability <*https://en.oxforddictionaries.com/definition/liability*> as a broad concept: "The state of being legally responsible for something." Core focus goes to *liability for emitting greenhouse gases* and, in this vein, to what is referred to as *third party liability*, in other words, legal responsibilities toward parties (victims of damage caused by

greenhouse gas emissions) with whom the potentially responsible person (the emitter) does not stand in any contractual relationship. Core attention goes to the function of liability rules for the mitigation of greenhouse gases (Bouwer, 2018).[2] This liability for emitting greenhouse gases exists (or can exist) in the area of public law and private law and can be subdivided into international, administrative, and criminal liability (public law liabilities) and tort law liability (private law liability).[3] Actions for holding individual and legal persons (such as states, authorities, and companies) liable can generally be triggered by citizens but also by legal persons, such as authorities, companies, and non-governmental organizations (NGOs) particularly environmental NGOs.[4]

This article discusses the main developments in these fields of climate liability and identifies major challenges.[5] Both a law and economics analysis and a positive methodology of law is applied, thereby identifying major developments in current climate liability law.

There are good reasons to focus on liability in relation to climate change in a volume on climate science. Increasingly a variety of actors (individuals, even children, and environmental NGOs) are exploring the possibilities offered by liability law in the fight against climate change.[6] One can indeed notice that various forms of liability are tried to force emitters to reduce their greenhouse gases or to force public authorities to impose (stricter) obligations on such emitters. The goal of our article is to sketch the different roads used in that respect in the legal field. This will be done by identifying the most important developments in the light of particular court cases that have been brought and by providing a theoretical perspective. The theoretical perspective used is the economic approach to law. That so-called law and economics doctrine is a useful approach as it has given a lot of attention, for example, to the different functions of specific legal instruments (more particularly safety regulation and liability) that can play an important role in mitigating greenhouse gases.

Economic Insights Into the Importance of Regulation and the Regulatory Effect of Tort Law

Instruments to Internalize Externalities

In order to understand the different liabilities that can play a role with respect to the mitigation of greenhouse gases, a brief theoretical sketch is needed. Traditionally in the field known as environmental law and economics, the goal of (environmental) law has been described as the internalization of externalities. The internalization of externalities does not imply the prevention of all environmental harm at all costs. Preventing all harm would not be socially desirable for the simple reason that it would be too costly. Cost-benefit analysis has to be applied to determine “optimal” or “efficient” pollution levels. Theoretically those are found where the marginal costs of pollution-abatement measures equal the marginal benefits in improved environmental quality.[7] In the context of climate change the externalities are the negative external effects caused by the emissions of greenhouse gases causing global warming and, consequently, climate change. These negative effects are caused by actors who emit greenhouse gases such as industries,

farmers, service providers, and citizens,[8] while the effects can potentially harm many different citizens, legal entities, and ecosystems. Actually, climate change can also have major consequences for environmental systems as such, including the environment that falls outside the jurisdiction of individual states (and is not owned by any natural or legal person). These various negative effects are external to the emitters of greenhouse gases[9] and therefore in principle not taken into account by those emitters when deciding how to act and whether, or with what intensity, they will take mitigation measures. Within this simple theoretical framework the goal of legal instruments therefore consists of forcing emitters toward an internalization of the externalities caused by greenhouse gas emissions. This does not necessarily imply an avoidance of all emissions (of which the social costs would be too high), but the use of cost-benefit analysis to determine an "optimal" level of greenhouse gases with the aim of avoiding dangerous effects.[10]

A wide variety of instruments has been discussed in the literature (and is employed in practice) to reach the internalization of (environmental) externalities. This literature concerns, on the one hand, ex post liability rules and, on the other hand, ex ante emissions regulation by the government. Ex ante emissions regulation can take different forms, and, basically, a distinction can be made between so-called command-and-control regulation[11] and market-based regulation (Stewart, 2007). The most well-known examples of market-based instruments are, on the one hand, a classic (in the sense that it was already advocated by Pigou in the 1920s) instrument, being *taxation*, and, on the other hand, *emissions trading*. Those regulatory approaches will not be explained in detail within the framework of this article, as they do not relate directly to liability, but it is important to notice that particularly in the framework of climate change, the use of those market-based instruments has been advocated and has to some extent been implemented as well. The literature has strongly debated the suitability of both taxation and emissions trading for mitigating greenhouse gases.[12] The European Union, California, certain Canadian states, and South Korea have chosen to implement emissions trading schemes, and China has also implemented emissions trading schemes at the subnational level.[13] Such emissions trading schemes—or other chosen emission regulations—provide the background against which the climate change liabilities central to this article may arise.[14] Below the two more traditional instruments to internalize externalities will be discussed, thereby explaining their functioning and the criteria relevant to choose between the one or the other. That will be helpful to understand climate liability under tort law.

Goals and Functioning of Liability Rules

A liability regime (in the common law referred to as tort law) has, from an economic perspective, the goal to provide incentives for deterrence to parties in an accident setting. Those parties are the potential injurer and the potential victim. They can influence the probability of an accident—and hence damage—by taking preventive measures, taking optimal care, and adopting efficient activity levels. In the environmental context the core idea is that liability rules signal to a potential polluter that the polluter will have to compensate for the damage suffered as a result of the pollution. That foresight would provide the potential polluter an incentive to invest in cost-efficient preventive measures, i.e., preventive measures of which the marginal costs are lower

than the marginal benefits in the reduction of the accident risk. The goal of liability law is then to develop liability rules that can provide incentives to the parties in the accident setting to adopt efficient care levels. A distinction is made between a so-called unilateral accident case (where only one party, the injurer can influence the accident risk) and a bilateral case (where both the injurer and the victim can take optimal care to reduce the accident risk). If one only considers ex ante preventive measures, most environmental cases and also climate change could be considered as unilateral as it is the emitter of greenhouse gases who can obviously take measures to reduce emissions. However, potential victims can take measures in the adaptation to climate change to mitigate the losses. That makes climate change to some extent bilateral as well.

A major difficulty in applying liability rules to climate change is that the potential damage that could emerge is often not known at the moment that an emission takes place, given the uncertain causal link between the emission and the potential damage. For that reason, it is very difficult to apply the traditional economic insight that the prospect of being held liable ex post to compensate for particular losses will provide an emitter ex ante incentives for preventing climate change: the link between the emission and potential losses is often too remote to allow a potential emitter to determine efficient emission levels in the way economic theory predicts.

Differences Between Regulation and Liability Rules

Leaving now the functioning of liability rules aside, one can understand that the alternative, ex ante emissions regulation, works completely differently. A tort system works in principle ex post, meaning that it is only after the harm has occurred that the legal system will intervene (more particularly, the court on request of the victim) and force the polluter to compensate for the damage. It is only the ex ante foresight of the ex post liability that will provide incentives for prevention.

The situation is completely different under regulation. In that case, a regulatory authority will fix beforehand (ex ante) the standard that has mandatorily to be followed by all potential parties in an accident setting. The flexibility and freedom inherent in the tort system in determining the optimal standard is largely missing in the regulatory approach, particularly in the form of command-and-control, where the government has to prescribe the rules with which the emitters must comply.[15] With market-based regulation, however, the choice for the individual emission levels, and the question of whether or not to take emission reduction investments, is left to the emitters, where it is expected that the governmentally established price of either the tax or the market price of the emission rights is the leading factor for decision-making, rather than the possibility of liability after the activity.[16] This means that the information costs related to ex ante emissions regulation varies according to the choice of instrument: information costs are largely incurred by the government in case of command-and-control but are largely incurred by the emitters in case of market-based regulation.[17] With this, a second difference between regulation and tort law is evident, in that the standards in regulation are set ex ante, before the damage happens, and that the standards in regulation have to be complied with irrespective of whether or not damage happens.

As a consequence, the third and probably most important difference between the two systems is that tort law is of course far more flexible, at least when compared with command-and-control regulation. In that sense, the tort regime is sometimes qualified as a market system: the private parties or the judge fix the norms,[18] and enforcement and sanctioning are also private. There is also a lot of flexibility within tort law to adapt to changing circumstances. Regulatory law, on the other hand, is much more interventionist: the norms (including the tax level or, with emissions trading, the cap on total amount of allowable pollution) are set by the government, while enforcement and sanctioning is ultimately a public responsibility. There is hence no doubt that the regulatory approach involves a much greater degree of government intervention than tort law. Tort law merely supposes that there is a judge who either sets the due care standard (in case of a negligence rule) and enforces tort claims of victims or merely does the latter (in case of strict liability).

A fourth difference is that with tort law, the victims have to take action to protect themselves and to try to get compensation for the damage. With ex ante emissions regulation, preventive action is aimed at by setting standards beforehand, implying that damage is prevented so that victims do not have to act *after* an accident happened.

Finally, a fifth difference is precisely that with ex ante safety regulation it can be strived for that certain (significant) damage will not happen at all, while with tort law, being an ex post mechanism, victims are supposed to take action to recover damages.[19]

Criteria for Safety Regulation

Having sketched how liability rules and safety regulation generally work from a theoretical perspective, the question now arises under what kind of circumstances liability rules are more indicated and when safety regulation should be preferred.[20]

Four criteria are distinguished in the literature to determine this choice. A first criterion relates to the information necessary to apply regulation or liability rules. Regulation requires information from administrative agencies; the application of liability rules requires information from either the judge (under a negligence rule) or the injurer (under a strict liability rule). The legislator, regulator, and administrative agencies can be expected to have better information than either the parties or the courts to set efficient standards for greenhouse mitigation.

A second criterion relates to the insolvency risk: if the potential damage is so high that it will exceed the wealth of an individual injurer, liability rules may not provide optimal incentives. This is a simple application of the principle that the deterrent effect of tort liability works only if the injurer has assets to pay for the damages he causes. If an injurer is protected against such liability, the problem of underdeterrence arises (Shavell, 1986).

Safety regulation can overcome this problem of underdeterrence caused by insolvency.[21] The damage related to climate change can obviously be substantially higher than the individual wealth of an emitter as a result of which the insolvency risk is real.

The third criterion is whether there is a sufficient threat from a liability suit. Latency (a long-time lapse between an emission and the damage) as well as causation problems could endanger the application of liability rules to provide incentives for greenhouse gas mitigations. Since climate change could lead to worldwide damage of many different kinds, it may be impossible to have an ex ante foresight of the potential ex post liability. Causation problems in climate change may reduce the possibility to apply liability rules.

In addition, the private enforcement underlying liability rules can also be presumed to be relatively weak. Climate change suffers typically from a so-called collective action problem. That means that the damage is widespread over a large community, in fact over the entire society. That therefore leads to the problem that the individual incentives of specific victims to bring a lawsuit may be limited. They suffer from so-called rational apathy or rational disinterest. It follows from the divergence between the private incentives to sue (which may be low) and the social interest (which may be high, given that there is a large social loss). Notwithstanding the large social loss, collective action problems will often prevent private enforcement of liability rules.

For all of those reasons these criteria concerning the choice between regulation and liability rules indicate a strong preference for emission regulation as the primary instrument to control the emission of greenhouse gases.

The Private Interest (Public Choice) Perspective

The previous theory, based on the framework of Shavell, therefore provides interesting criteria for the choice between liability rules and regulation. This is also referred to as the public interest theory of regulation as it assumes that the regulator would in the public interest decide whether it is better to internalize externalities via ex ante safety regulation or via ex post liability rules.

However, there has been another, to some extent competing stream of literature that has provided another perspective and argued that regulation is not (always) made in the public interest but very often in the private interest, more particularly in the interest of powerful interest groups that lobby for regulation that provides them particular advantages (referred to as rents). That other approach is referred to as the private interest theory, also known as public choice.

The public choice school has powerfully shown that (environmental) regulation is not always made in the public interest but often merely to serve private interests, more particularly special interests representing industry. Special interest groups will seek regulation that confers particular advantages to them. Those advantages are often referred to as rents, more particularly in the work of Nobel Prize winner James Buchanan. The activities of special interest groups are hence referred to as rent-seeking. The circumstances under which rent-seeking will be successful have been identified in the important work of Mancur Olson (1971): the information costs for the public at large need to be high and the transaction costs for the group to get organized relatively low. Those conditions are often fulfilled in the case of environmental regulation. Often the number of participants in the special interest group is relatively limited as a result of which transaction costs to be organized are low (this is referred to as the group being single-issue

oriented). Moreover, environmental regulation is often of a highly technical nature, as a result of which it is often very difficult, if not impossible, for the public at large to discover that in fact rent-seeking has been going on. Although this may generally be true for technically complicated environmental regulation, one advantage of climate change is that, thanks to exposure in the media and activities by specialized environmental NGOs, failing government policy with respect to climate change will often be exposed, thus potentially leading to awareness of the public at large of the specific issue.

Maloney and McCormick (1982) were probably the first to show that with environmental regulation, industry will try to change the contents of the regulation to its advantage. They argue that industry, realizing that environmental regulation is unavoidable, will cooperate with the development of the regulation and try to change the contents to its advantage. A classic example is the introduction of so-called "grandfather clauses," which stipulate that the regulation will not be applicable to firms or products already active on the market. Nash and Revesz (2007) showed that new regulations with grandfather clauses will retard the introduction of new, clean plants and will keep inefficient plants operating longer than they otherwise would. Furthermore, a generous free allocation of emission rights, such as under the European Emissions Trading System, implies fewer incentives for industries to apply pollution abatement (Endres & Ohl, 2005; Woerdman et al., 2008).[22]

It is, however, important to mention that public choice theory also predicts that if it were possible to organize a countervailing power against industry lobbying, a kind of competition between various pressure groups could emerge, the result of which may be closer to the optimum than when government is only lobbied by pressure groups representing industry interest.[23] Binder and Neumayer (2005) present some powerful empirical evidence of this for the environmental area. They provide a systematic quantitative test of the relationship between the strength of environmental NGOs and air pollution levels. They find that environmental NGOs exert a statistically significant impact on sulfur dioxide, smoke, and heavy particulate concentration levels based on a cross-country time series regression analysis. That study thus provides an important empirical backing for something environmental lawyers have advocated: public participation and NGO influence will effectively help to achieve lower pollution levels (Binder & Neumayer, 2005). Public participation can thus effectively counter industry lobbying and make standard-setting by administrative agencies more in the public interest. However, this may only be a remedy in societies that allow NGO activity and public participation, but not in legal systems where this is still problematic. Furthermore, while NGO activity is traditionally strong with local pollution (where it is relatively easier to motivate affected citizens to take action), it seems that NGOs increasingly succeed in motivating the public at large to become concerned with respect to a problem that has global effects like climate change.

Regulation or Liability Rules for Climate Change?

If both the public interest and the private interest insights are to be applied to the case of climate change and more particularly to the question of how emitters such as transport businesses, farmers, and industries can be provided incentives to mitigate greenhouse gases, the following

can be said: as already indicated in the section "Criteria for Safety Regulation," taking Shavell's criteria for regulation, there is no doubt that liability rules alone could not provide incentives for mitigation to emitters.

Taking the first criterion, information, it may be clear that assessing the consequences of greenhouse gas emissions is an extremely complex issue that an emitter may not be able to evaluate. Greenhouse gases can also be emitted by small- and medium-size enterprises which may not have the capacity to undertake complex studies on the optimal[24] ways to mitigate greenhouse gases. It is therefore more efficient to allow the government to do this type of research on the optimal standard.[25] The result of this research can then be passed on to the parties in the market through the regulation. Moreover, these standards for efficient mitigation of greenhouse gases would not be examined just for one individual firm but for the entire market. This also shows that it is more efficient from an "economy-of-scale" perspective to have the government do the necessary research on optimal mitigation measures rather than individual firms engaging in this examination.

Also, insolvency may be a problem that justifies regulation. The consequences of climate change may be very large and potentially much larger than the assets of small firms that contribute to climate change. The amount of damage caused by greenhouse gas emissions could greatly exceed the assets of an individual company. Companies are also often incorporated as legal entities and therefore benefit from limited liability.

Furthermore, the probability of being sued for the consequences of greenhouse gas emissions is very low. Climate change damage is spread over a large number of people, potentially the global population. They will have large difficulties in organizing themselves to bring lawsuits against emitters of greenhouse gases. In addition, the results of climate change could become apparent only years after emissions of greenhouse gases took place. That will undoubtedly lead to many problems of causation and latency, which would make it difficult for a lawsuit to be brought under liability rules against an emitter of greenhouse gases.

For these reasons it is clear that the primary instrument to control emission of greenhouse gases should be ex ante government regulation. To reformulate: this theoretical analysis shows that liability rules alone cannot suffice to provide incentives to emitters of greenhouse gases. There is a need for other, publicly imposed instruments to reach this goal. Legislators have a wide basket of regulatory tools to choose from, such as command-and-control, but, as mentioned, taxes and emissions trading could obviously be an alternative. These would also be publicly imposed and would therefore also be considered as regulation within the framework of Shavell.

However, the mere fact that ex ante public regulation should be the primary instrument to provide incentives for mitigation to emitters of greenhouse gases does not imply that there would no longer be any role for liability rules. From a theoretical perspective several arguments can be made to justify a complementary or supplementary role of liability rules to back up ex ante regulation. One reason for still relying on liability rules is that ex ante government regulation is often static and not sufficiently dynamic. Regulation is often laying down a particular standard at one moment, whereas the technology—and, especially in the field of climate change, scientific

insights on the effects of emissions—may quickly develop as a result of which the regulatory standard could be outdated. Liability rules (both strict liability and negligence) have the advantage that they can much more easily adapt to changing (technological and scientific) circumstances. A second problem is that the regulatory standard is not always the optimal, the efficient one, precisely because of the influence of lobby groups on regulation to which public choice theory has rightly pointed. That influence can to some extent be overcome by combining ex ante public regulation and liability rules. Finally, it was already stressed that ex ante public regulation only works to the extent that there is enforcement. It is well known that, for a variety of reasons, enforcement is often suboptimal as a result of which there may also not be perfect compliance with emission regulation.

From all the above it follows that, although there is a strong case for ex ante emissions regulation to control greenhouse gas emissions, liability rules will still play an important role. The extent to which this supplementary role of liability rules could play an important role in the case of greenhouse gas emissions will be further addressed below in the section "Tort Liability of Companies vis-à-vis Public Regulation."

Climate Liability Under Public Law

Climate Responsibilities and Liabilities Under International Law

The main actors of international public law, the states, have the capability to establish international legal frameworks for reducing greenhouse gases. However, while states have, in principle, wide possibilities to regulate strong emission reduction obligations and liability mechanisms in treaty law, the practice thus far shows great reluctance. The dilemma in international law is that consent is needed from states in order to be subject to binding commitments. In this vein, the International Court of Justice (ICJ) can only issue binding decisions upon a state as far as this state has accepted its jurisdiction.[26]

The Paris Agreement of 2015 illustrates that states have not succeeded in establishing a clear and enforceable legal framework to prevent climate change damage. This Agreement does not contain clear and enforceable substantive emission reduction commitments for parties, nor does it contain provisions on emission reduction commitments for private parties that states would have to impose on them. Furthermore, the Agreement contains rather vague and open-ended arrangements for financial compensation, which often can only be seen as recommendations instead of legal obligations (Bodansky, 2016). For instance, the inclusion of a "Loss And Damage Mechanism" in international climate treaty law—providing inter alia financial compensation for developing countries that are particularly vulnerable to the adverse effects of climate change—is a cumbersome trajectory, and the Paris Agreement basically only regulates that this issue has to be further elaborated by the parties to the Agreement.[27] Article 9 of the Paris Agreement contains stronger language and provides that "Developed country Parties shall provide financial resources to assist developing country Parties with respect to both mitigation and adaptation in continuation of their existing obligations under the Convention." The "shall" in this sentence amounts to a legal commitment which is, in this case, of a collective nature since it addresses all

developed countries (Bodanksy, 2016, p. 147).[28] Important elements, such as how much each developed country should pay, and how much developing countries are entitled to receive, and in what circumstances, are subjected to further decision-making by the parties. While some political willingness on the part of developed countries to provide finance (which can be used for preventing or compensating climate change damage) is illustrated by article 9, it has yet to be seen how and to what extent this will be implemented.

Hence, thus far, the international treaties on climate change law fall short of regulating the liability of states (or of emitters) for damage caused by their emissions.[29] Moreover, international treaty practice has learned that the relatively strong compliance mechanism of the Kyoto Protocol, in combination with precise emission reduction obligations for states that ask for emission reduction efforts in their economies, may have as a result that states are less willing to adhere to the Treaty (as, for example, the United States, who did not ratify the Kyoto Protocol) or may even decide to withdraw from it (as Canada did).[30] Moreover, from national jurisprudence it can be learned that courts, at least within Canada, did not find it possible to judicially review whether Canada substantively complied with the Kyoto Protocol, given that Canadian national legislation created "a comprehensive system of public and parliamentary accountability as a substitute for judicial review" (*Friends of the Earth v Canada*, 2008).[31] According to Christopher Stone, if such strong roles by courts were taken, countries considering whether to join international environmental agreements would be all the more hesitant to do so (Stone, 2010, p. 55).

In view of the fundamental characteristic of international public law that states will in principle only be bound if they give consent to it and, consequently, the absence of strong regulatory and liability mechanisms in treaty law, bottom-up developments emerge in national jurisdictions, particularly by means of court procedures started by individuals and environmental NGOs. In this vein, the possible soft effect of an advisory opinion from the International Court of Justice (which would be non-binding) on the responsibility of states in view of climate change—thereby clarifying the obligations that follow from the international principle of "no harm" (basically meaning that activities carried out under the jurisdiction or control of a state do not cause environmental damage to other states) (Sands & Peel, 2012)[32]—should not be underestimated and could have important influence on national judges when developing their decisions (Voigt, 2016, p. 164).[33] At the same time, the effect of an ICJ decision—for instance, if it would enter into the issue of burden sharing of emission reduction commitments among states (Sands, 2016)[34]—could also be disruptive to the international negotiations for further international rule-making and, notably, also negatively influence the willingness of states to continue to accept the jurisdiction of the court. In this sense, while in theory possibilities exist for the ICJ to provide interpretations or decisions on the legal responsibilities and liabilities of states in the field of climate change, the effect of such decisions on real progress of international regulatory action is hard to predict. (For a discussion of state responsibility versus state liability, see Kosolapova, 2013, p. 36.)

Greenhouse Gas Emission Regulation at the Domestic Level

The shortcomings of international climate treaty law did not prevent various states from adopting greenhouse gas emission reduction regulation, through which obligations have been imposed on emitters regarding the reductions of greenhouse gases.[35] Moreover, the Kyoto Protocol regulated emission reduction obligations for various states, who consequently had to adopt emission reduction obligations in their jurisdictions to ensure compliance. The European Union took its Kyoto Protocol target particularly seriously and introduced a package of laws for implementing its emissions reduction obligation.[36] As a next step, it adopted in 2009 a package of laws to implement an emission reduction target of minus 20% by 2020 compared to 1990 and is in the course of establishing a package for targeting an at least 40% reduction of greenhouse gases by 2030 compared to 1990.[37] The main regulatory instruments used are (1) an EU-wide emissions trading system (EU ETS) and (2) a package of individual emission reduction obligations for member states applicable for activities not covered by the EU ETS. This EU approach is an example of ex ante emissions regulation through which, differently from tort law, the government sets standards instead of the courts. However, the EU approach is not so much characterized by setting specific technology standards for emitters, but is heavily based on a market-based approach. The main aim of the regulation—to reduce greenhouse gases—is translated into a total cap on emissions under the EU ETS and by means of caps on emissions by member states for those emissions not covered by the EU ETS. These caps should, in principle, guarantee that the environmental effect will be reached while introducing emissions trading possibilities for the regulated (both the emitters covered by the EU ETS, as member states having individual emission caps may trade their emission rights) aims to enhance cost-effective solutions.[38]

For developing such ex ante emissions regulation, as the EU did in its specific supranational order, states enjoy, in principle, large discretion in the design of the emission reduction obligations. Illustrative is a US court decision stressing discretion at the side of the legislator as to which sources will be subjected to emission reduction regulations.[39] This approach can also be identified in EU case law where the Court of Justice of the EU allows for a step-by-step approach, allowing large discretion to the legislator as to determining the coverage of the EU emissions trading legislation (CJEU, 2008).[40]

A particular regulatory challenge in the field of climate change is how to deal with the so-called issue of carbon leakage: imposing strict obligations on international competing industries could lead to fewer emissions within the jurisdiction, but if the production of the products or if services move to another country (or if products and services from other countries are increasingly bought by the consumers within the jurisdiction), the total amount of emissions may stay the same and only moved to other jurisdictions with less sharp obligations. In this sense, the EU legislator chose to adopt a special regime for the carbon leakage sector under the EU ETS, providing them with free allowances on the basis of specific benchmarks. (On carbon leakage, including the EU measures, see Shoyer et al., 2016.) WTO measures may also come into question in case states consider adopting border measures to prevent carbon leakage effects and the applicability of the WTO requires meticulous consideration.[41]

A specific question is also whether a state can regulate emissions caused outside its territory. Although the decision is not without scholarly criticism, the CJEU approved the decision of the EU legislator to include emissions from flights outside EU territory within the EU ETS (CJEU, 2011).[42] With this unilateral measure, the EU tried to fill the gap of international treaty law, which until then had left the greenhouse gas emissions of aviation largely unregulated. Nonetheless, political sensitivities have led EU politicians to decide to stop the clock, which means that the onus again rests on the (cumbersome) international community of states convened in the International Civil Aviation Organisation (ICAO) to adopt regulatory approaches for reducing aviation emissions or, alternatively, to the parties to the UNFCCC. The question of which regulatory framework (ICAO or UNFCCC, including the Paris Agreement) should regulate international transport emissions has become a sensitive issue for which no clear decision is outlined in the Paris Agreement.

In sum, states have wide possibilities to enter into international agreements and to adopt (also domestically) ambitious emission reduction regulations. Generally, depending on the precise jurisdiction, courts give large discretion to legislators for choosing the regulatory instrument and designing its specific form. Nonetheless, while the Rio Declaration indeed points at the need for "effective regulation," emitters enjoy to some extent—depending on the specific jurisdictions—legal protection against governmental measures that intervene in their economic (and private) situation.[43] Based on the rule of law, emitters may try to go to court to argue against in their view unlawful regulatory or administrative decisions with which they are confronted, such as US air operators have done in order to address the unlawfulness of the inclusion of extraterritorial flight movements into the EU ETS (but lost) (CJEU, 2011). Law practice from the EU illustrates that, thus far, several industries have brought decisions taken under the EU ETS before the courts in order to find relief from the EU ETS obligations imposed on them. Such cases often deal with how the regulatory approach plays out in a specific individual circumstance. Thus far, the core regulatory decisions under the EU ETS, such as the scope of the regulatory approach, the level of the financial penalty, and the inclusion of extraterritorial flight movements, have been found lawful by the CJEU.[44]

Climate Liability Arrangements Under Public Law

Besides imposing emission reduction obligations, states can also adopt arrangements for holding emitters responsible for the damage they cause by emitting greenhouse gases.[45] For instance, within EU law, an Environmental Liability Directive has been adopted which regulates that polluters have to restore or compensate for the environmental damage they have caused.[46] This regulatory approach is, however, not designed specifically for climate change damage and, moreover, does not incorporate damage to personal and economic damage.[47]

An alternative for a liability scheme would be that a government creates funds based on obligatory payments from emitters through which then compensation for climate damage (or compensation for taking preventive measures) can be paid.[48] In this way, financial responsibilities as regulated in the Paris Agreement, as noted above, can be implemented.

In other words, as far as ex ante emission regulation is not preventing climate damage,[49] regulatory frameworks can be designed in order to provide financial means so that victims will be compensated in case damage occurs. There are several ways for doing so, such as using the profit from the auctioning of emission allowances for providing compensation to victims. For instance, EU ETS legislation suggests member states to use the revenue from the auction for financial and fiscal support policies for (in particular also) developing countries.[50] In this way, a mix is made of, on the one hand, regulating emission reductions and, on the other hand, creating a fund to be filled by payments by emitters, which can be used (whole or in part) for financial compensation to adapt to (extraterritorial) impacts of climate change. In this way, emitters contribute financially to preventing certain damage caused by climate change. The law and economics literature with respect to compensation funds has indicated that, provided that compensation funds are designed in a smart way, they could fulfill the aims of both prevention and compensation. An important condition would be that the contributions to a compensation fund would be risk-related (implying that emitters would have to contribute to the fund in relation to their emissions) so that the creation and working of the fund would provide not only compensation but also incentives to mitigate emissions (for the conditions necessary for the efficient working of a compensation fund, see Faure & Hartlief, 1996).

Climate Liability Under Tort Law

Tort Law Liability as a Complement to Greenhouse Gas Regulation: Examples From Practice

While in principle states have many possibilities to impose emission reduction obligations and compensation obligations on emitters, it is not excluded that, in a complementary sense, liability law as provided by tort law may play an important role, particularly if regulatory action falls short. A test case in this respect is a claim submitted by a Peruvian citizen (supported by NGOs)[51] to one of the largest fossil fuel energy companies and, related to this, carbon dioxide emitters in the EU (RWE), situated in Germany. The core argument is that his property is threatened because of the melting of a glacier, which, if it results in an outburst flood, would seriously harm his house and thus his property (see *Saúl versus RWE* for information provided on behalf of the claimant, including part of the court documents <*https://germanwatch.org/en/huaraz*>. The argument is that RWE—being a mother-company covering many subsidiaries—has contributed to this threat (by emitting 0.5% of global greenhouse gas emissions since industrialization started) and, consequently, should cover, proportionate to its share of global greenhouse gas emissions, the expenses for appropriate safety prevention measures that have to be taken.[52] The claim has been found admissible by a German court and is now pending for substantive adjudication.[53] One of the interesting legal questions that may arise is whether a company, being covered by the EU ETS, can be held liable for its emissions caused under this (EU) public law regulatory scheme if it will be held that a causal relationship can be vested between the emissions from the industry and the specific threat.[54] Many other legal questions may have to be answered

by the court, such as whether a company can be held liable for emissions caused before governments recognized the need to regulate such greenhouse gases (for instance, before the conclusion of the UNFCCC in 1992) or before the establishment of the IPCC in 1988.

These legal questions will have to be answered according to the specificities of domestic jurisdictions, which can imply that in relatively comparable cases, different court decisions may follow.[55] One of the challenges of legal scholarship will be to investigate how, in different jurisdictions, claims for compensation will be adjudicated.[56] Information regarding the way in which domestic courts deal with claims for compensation can of course inform strategic decisions of future claimants. From a law and economics perspective, it will be interesting to investigate whether a court procedure like this, if the claim is awarded, will indeed induce preventive action on the part of the emitters.

In addition to judicial procedures aiming to enforce financial compensation for adaptation measures, practice shows that court actions have been initiated against companies and governments to enforce emission reduction obligations. In the United States, for instance, it became clear that the Environmental Protection Agency must consider greenhouse gas emission regulation (*Massachusetts et al. v. Environmental Protection Agency et al.*, 2007; for discussion, see Freeman & Vermeule, 2007). Basically, the Supreme Court found in this case that the EPA had to carry out this task in view of its duties as regulated in the Clean Air Act. Subsequently, in another case adjudicated by the US Supreme Court, this time based on tort law (more specifically, US federal common law), it was found that there is no place for tort law to enforce reduction of greenhouse gas emissions from fossil fuel–fired power plants if public regulation has been provided (*State of Connecticut, et al. v. American Electric Power Company Inc., et al.*, 2011). This means that actors who are not satisfied with the decisions under public regulation should take these governmental decisions to court. The Supreme Court made in this respect interesting considerations such as that the EPA—as an expert agency—is best suited to serve as the primary regulator of greenhouse gas emissions (p. 14). Regulating greenhouse gases requires an "informed assessment of competing interests" and "complex balancing" (p. 3), and an expert agency is surely better equipped "than individual district judges issuing ad hoc, case-by-case injunctions."[57] Moreover, "federal judges lack the scientific, economic, and technological resources an agency can utilize" (p. 14).

At the same time, and in contrast, in a revolutionary court decision in The Netherlands of June 24, 2014, a lower district court found reason to intervene into decision-making by the state and ordered the state of The Netherlands to pursue a higher greenhouse gas ambition than imposed on it by EU legislation (*Urgenda v The State of the Netherlands*, 2015). This case, based on tort law, shows that in current practice, and depending on the specific jurisdiction and the specific circumstances of the case, tort law is given a role complementary to public regulation. At the time of writing, this decision is under appeal.

These case law developments serve to illustrate that there is a trend to try tort law in order to enforce more ambitious greenhouse gas emission reductions than provided for by public law; of course, such attempts can also be made within the sphere of public law depending on the specific legal system of a jurisdiction (and should according to these specificities sometimes be used instead of tort law). In such cases—asking for more ambitious action and particularly asking for

more ambitious emission regulation—one of the challenging questions is with what ambition or intensity states have to adopt ex ante emission laws. This basically deals with the question of how much reduction should take place in a country during a certain time frame.[58] If courts engage in this, they will function as standard setters, which raises the question as to upon what (scientific) information their decision will be based and also to what extent normative "regulatory" decisions will be made—for instance, whether a nationally determined contribution of a certain state reflects its "highest possible ambition."[59] It is impossible to provide a clear picture in this early stage of case law development, and it is particularly hard to predict whether (many) courts will step in as regulators of emission reduction.[60] In this respect, literature has drawn attention to the difficult task that courts may face when adjudicating climate change claims. Elisabeth Fisher and co-authors point at the normative challenge for courts in resolving climate disputes "well," as well as the complexities involved in doing so (Fisher, Scotford, & Barritt, 2017). In this respect, it can be expected that courts may face difficulties in how to adjudicate the correctness of standards imposed through emission regulation law, particularly where it concerns the ambition (intensity) of the standard. This may also lead to (fierce) debates examining whether judges take an activistic role, meaning that they create new law not finding a basis in democratic decision-making.[61]

Tort Liability of Companies vis-à-vis Public Regulation

Limits of Emission Regulation

The section "Tort Law Liability as a Complement to Greenhouse Gas Regulation" has sketched that tort law liability is increasingly used as a complement to greenhouse gas regulation. How can that be viewed in the light of the theoretical literature as presented in the section "Economic Insights on the Importance of Regulation"? Clearly, given the nature of climate change, there are strong reasons to rely on emission regulation as the primary instrument to provide (incentives) for reductions of greenhouse gas emissions (see section "Regulation or Liability Rules for Climate Change?"). However, the private interest analysis provided in the section "The Private Interest (Public Choice) Perspective" showed that regulators and administrative agencies can be strongly captured by the industry. In that respect, when the danger of capturing by private interest is included, there are important differences between regulation via administrative agencies, on the one hand, and liability rules applied by the court, on the other. Regulation via administrative agencies has the disadvantage that, given the strong financial interests, industry will undoubtedly lobby to obtain lenient emission standards. Industry is sometimes qualified as the "merchant of doubt," trying to use uncertainty as an argument to obtain lenient (in some cases inefficient) standards. The effective countervailing power by, for example, NGOs may fail given their limited capacities. Of course, in the climate change arena, one could point at the important role of active NGOs. The advantage of the climate change problem is that, due to its serious character, it receives a lot of media attention. Also, with increased opportunities to access information held by the government, environmental NGOs can in principle monitor the standard-setting for greenhouse gas emissions, although there may still be transparency issues such as the fact that enforcing the disclosure of information may need to be done through the court. At least from a theoretical perspective there still is the fear that the conditions of Mancur

Olson for successful lobbying and rent-seeking (low transaction costs for the group and high information costs for the public) are fulfilled. It is also not certain to what extent there could be a competitive lobbying process in the style referred to by Gary Becker whereby NGOs or other interests representing "the climate" would counter industrial lobbying. In sum, in case of standard-setting for mitigation of greenhouse gases through administrative agencies or, more generally through the regulator, there is, at least from a theoretical perspective, a large danger that private interest may dictate the outcome. With this it cannot be said that that is actually the case. But on the basis of the theoretical predictions sketched in the sections "The Private Interest (Public Choice) Perspective" and "Regulation or Liability Rules for Climate Change?," it can be argued that the likelihood of a suboptimal standard-setting is realistic.

This is not necessarily the case with the judiciary. Judges in most national courts are appointed for life,[62] and industrial lobbying hence does not have a similar influence on the judiciary. Whereas judges may therefore lack information, they do have the advantage of a higher likelihood to act independently and to decide in the public interest.

A Trade-Off

Taking those two arguments together, on the basis of theory there is hence a trade-off: public authorities may have better information but incur a higher risk of lobbying by special interests; the judiciary may have less information but a better likelihood of making a decision in the public interest.

It is precisely because of this trade-off that it was argued that liability rules could play an important role in backing up the standard-setting for the mitigation of greenhouse gases via tort law (see section "Regulation or Liability Rules for Climate Change?"). It is therefore not surprising that NGOs and others have investigated the possibilities of either governmental responsibilities (discussed in the section "Limits of Emission Regulation") or responsibilities of companies to further abate greenhouse gases emissions. With this statement it is not suggested that this is a desirable development; we merely state positively that based on the theory it can be expected that plaintiffs will seek to use the supplementary role of tort law to force either governments (see section "Tort Liability as a Complement to Greenhouse Gas Regulation") or companies to take more ambitious actions via tort law.

An important argument (at least from a theoretical perspective) is therefore that liability rules could remedy suboptimal standard-setting in emission regulation as a result of industry lobbying. However, as already indicated, climate change is an area that enjoys specific attention in the media, and domestic law (as well as the Aarhus Convention) increasingly awards rights concerning access to information and transparency, which may also counter the lobbying risk. To the extent that those efforts are successful, there is again a greater likelihood that standard-setting via emission regulation would be in the public interest, thus reducing the need for a complementary role of the courts via liability law. Moreover, even when there would be a need for a complementary role of the courts, several remaining questions arise, inter alia how the courts can obtain information to come to optimal decision-making.

Remaining Questions

Of course with such a use of tort law, a lot of questions may arise that plaintiffs (and courts) will have to deal with. One obvious issue, already mentioned, is how courts will be able to obtain accurate information on optimal standard-setting, for example with respect to optimal greenhouse gas emissions.[63] Again, there is a dilemma: on the one hand, it has to be avoided that courts would engage in second-guessing efficient agency decisions; on the other hand, it is (given the danger of lobbying) not always certain that decisions taken by agencies are indeed efficient. But that still raises the question of how courts obtain information on optimal standards and how, in other words, climate change can enter the courtroom. In other cases where courts have played an important role in environmental policy (for example, in environmental public interest litigation in India), the courts used administrative agencies and more particularly experts from the Ministry of the Environment to be informed on optimal standards. Something similar could take place in the climate change arena as well, but still the question arises to what extent courts are able to effectively interpret the information provided by the experts.

A second question that undoubtedly will arise in any case of private enforcement in the climate change area is, of course, causation. The evidence of a general causation, i.e., that greenhouse gas emissions may be related to climate change, does not seem to be an issue that can still seriously be contested; the more relevant question in a tort setting is obviously specific causation, i.e., the extent to which the particular defendant's emissions have or are still contributing to climate change. With larger emitters that will obviously be easier than with smaller ones. Changes in the concept of causation have made this proof easier. By not applying a so-called threshold liability rule (which would require the plaintiff to show that there is a more than 50% likelihood that the defendant's behavior caused the damage), but by moving to a so-called proportional approach, the possibilities to apply tort law to climate change surely increase. Moreover, causation issues mostly arise in case of an action for damages. While damage actions have started,[64] probably many other cases will relate to an injunction addressed against a particular company, asking the judge to force the specific defendant to further reduce emissions of greenhouse gases.

Of course many other issues may and will arise in a climate change case against a company as well. The issue mentioned earlier related to rational apathy that could arise in case of a so-called collective action problem would still prevent individual plaintiffs from bringing costly lawsuits. However, increasingly innovative techniques are being employed to solve the collective action problem in climate change litigation. For example, the case of the Peruvian farmer against RWE was financed via crowd funding. Moreover, the collective action problem could and is in many legal systems remedied either by allowing large locus standi or by increasing the possibilities of collective action and granting rights to NGOs to act, for example, on behalf of the affected environment or future generations.

The Potential of Climate Change Liability

Summarizing, based on the theory presented in "Climate Liability Under Public Law," it is likely that tort liability will be used as a supplementary instrument against companies to seek a further reduction of greenhouse gas emissions. The extent to which that instrument (tort law) will be

used will depend upon a variety of factors. One important element is the relative ability to acquire expertise and information on optimal greenhouse gas emissions by either an administrative agency or the court. In that respect, as indicated, the trade-off is between a (theoretically presumably) captured agency versus an independent court. But how that trade-off works out may of course also be country- and context-specific. In legal systems where courts are extremely weak, it is not to be expected that private enforcement via the court would be an effective instrument. To the contrary, in legal systems where the regulatory regime concerning greenhouse mitigation is relatively weak and the court system is very strong, the use of tort liability against both public authorities and companies can be expected. The latter is obviously the case for the United States where, on the one hand (at least at the federal level), regulation concerning the mitigation of greenhouse gases is limited and where many climate change liability cases (at least against public authorities) can be observed. It is, however, striking that climate change litigation can be observed not only in the United States but also in Europe, although the EU has established a relatively ambitious greenhouse gas reduction program (see cases discussed in section "Tort Liability as a Complement to Greenhouse Gas Regulation," all dealt with by European courts).The most difficult cases are obviously those where a regulatory system concerning greenhouse gas mitigation has been put in place and where the court system is strong but where particular groups consider the regulations as being insufficient. The latter was obviously the case in the earlier discussed case of Urgenda, which also explains why that particular case is so debated.

Concluding Remarks

It is difficult to predict how in legal practice litigation may contribute to addressing the climate change problem and how, more specifically, tort law will play a role in reducing greenhouse gas emissions in an effective and efficient way. The seminal author Christopher Stone, famous for his plea for strengthening the representation of the silent environment in law, has stated that "No litigation of any sort is going to have a major impact on climate policy" (Stone, 2010, p. 70). Others urge that judges act courageously in the field of climate change (Spier, 2010, p. 448). At the same time, literature has also discussed the complexity of adjudicating in the field of climate change (Fisher et al., 2017).

Meanwhile, many claims across the world are brought to courts attempting to change governmental and business approaches to mitigating climate change. The success of tort law actions will most likely also depend on the (lack of) ambition vested in emissions regulations at international and national level. Nonetheless, although it is difficult to measure, already the fact that claims have been submitted and, consequently, threats for condemnations or subsequent claims are felt by emitters can induce some managerial change within not only political institutions but also companies. Moreover, several claims do not seek compensation for taking adaptive action to avoid climate change damage, such as in the case of the Peruvian farmer suing RWE, but aim directly at the reduction of greenhouse gas–emitting activities, such as is the case with the Urgenda case, and with a claim from Friends of the Earth to Shell *<https://en.milieudefensie.nl/news/friends-of-the-earth-netherlands-starts-climate-lawsuit-against-shell>*, thereby claiming that the greenhouse gas–emitting activities of this company should

fundamentally change. While it is up to the national jurisdictions whether such requests for regulatory action can be submitted on the basis of tort law (instead of public law provisions), any court decision that deals with requests for more ambitious action will actually address an important regulatory issue. One of the exciting questions for the near future is to what extent judges feel able to step into the regulation of the climate change problem in an ex ante way. A big experiment with judicial adjudication is on the brink of taking place across the world, and practice will show to what extent tort law is able to exert a positive effect on the ex ante mitigation of greenhouse gases.

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Notes

1. In 2017, energy-related greenhouse gas emissions (CO_2) increased globally by 1.4%, reaching a historical high of 32.5 gigatons in 2017 after three years of remaining flat (International Energy Agency, 2018).

2. Since this topic is already broad and complicated, we exclude product liability (damage by malfunctioning solar panels or wind turbines) and contractual liability (e.g., devices emitting more greenhouse gases than contractually agreed). For the importance of taking an inclusive approach to examining climate liability, see Bouwer (2018).

3. The issue of criminal liability would need a separate contribution to this volume and will consequently not be discussed here.

4. The focus implies that we de facto largely focus on the function of liability rules (in the sense of legal responsibilities) for the mitigation of greenhouse gases. There is another, of course equally important, aspect of the climate change debate known under the concept of adaptation. The liability question there is whether individual and legal persons, including authorities, can be held liable for not taking sufficient adaptation measures, such as establishing construction works to avoid serious personal and economic harm from floods. Obviously, adaptation could lead to interesting questions of liability (and mostly insurance) when addressing the damage that could result from climate change. But those aspects will not be studied here, where we focuses on liabilities in relation to mitigation. We also do not delve into the important question of whether mitigation or adaptation would be more efficient in certain cases.

5. The research for this article was concluded on July 31, 2018; later developments have not been included.

6. In US law particularly, subnational authorities also make use of liability claims in the field of climate change.

7. This is obviously easier stated than implemented in practice. Many difficulties and debates may arise, for example, concerning the question of how benefits (in the sense of improved environmental quality) should be calculated.

8. Financers of greenhouse gas–emitting activities, such as banks and pension funds, also contribute indirectly to greenhouse gas emissions.

9. Although emitters may also ultimately suffer from negative effects from climate change, such as farmers who may be confronted with changing weather conditions that may impact their business. However, there is no direct relation—or at least this is difficult to establish—between the emissions from an emitter and the precise consequences of these emissions on the emitter.

10. The UNFCCC does not aim to reduce all emissions but, in article 2, calls for "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."

11. This is in the law and economics literature referred to as "safety regulation," more particularly in the well-known study by Shavell (1984).

12. A rich literature exists; see, e.g., Hovi and Holtsmark (2006).

13. An overview of adopted and intended emissions trading programs is provided by the International Carbon Action Partnership <*https://icapcarbonaction.com/en/*>. In practice, hybrid forms of emissions trading emerge, such as in the EU ETS, where the revenues from the sale of allowances are used for subsidizing innovation and where a member state (UK) chose to impose a national tax in addition to the EU ETS system.

14. Also, voluntary emission compensation approaches have flourished and may be a means for citizens and business to offset emissions caused by their activities. For instance, the secretariat to the UNFCCC has called on businesses and individuals to offset emissions they cannot reduce by using UN-certified emissions reductions (United Nations UN Climate Press Release, Go Climate Neutral Now <*https://unfccc.int/news/go-climate-neutral-now*>, September 22, 2015.

15. In such command-and-control standard-setting, cost considerations are often included; see, for instance, preamble 16 of the EU industrial emissions directive: "In order to take into account certain specific circumstances where the application of emission levels associated with the best available techniques would lead to disproportionately high costs compared to the environmental benefits, competent authorities should be able to set emission limit values deviating from those levels."

16. It needs to be noted that the government sets the tax or the cap level for which it bears information costs (and it can be questioned to what extent in this respect optimal choices are made).

17. Depending on the specificities of the regulatory command-and-control approach, informational costs can be put on the emitter. For instance, it may be that the operator is required to develop an environmental impact statement report; also the requirements for applying for a permit can mean that the operator has to investigate and propose specific technologies for reducing negative impacts on the environment in its permit request.

18. This raises the question of how judges can set standards specifically in the case of climate change.

19. This argument is not true in case a tort law mechanism has ex ante effect. However, particularly in case of climate change, scientific reports that demonstrate that sufficient emission reduction action has not been taken show that, at least for this moment, the ex ante effect of climate liability law is not sufficiently strong.

20. This choice between regulation and liability was thoroughly examined in a study by Shavell (1984) in which particular criteria are advanced influencing the choice between safety regulation and liability rules.

21. If insurance came into the picture, it could overcome the problems of underdeterrence provided that the moral hazard problem, caused by insurance, can be overcome.

22. Of course, the total amount of emissions in the time period 2008–2012 had to comply with the Kyoto Protocol's obligation for the EU to reduce 8% compared to 1990. This means that if more allowances were allocated to EU ETS industries, less emission budgets were available for sources not covered by the EU ETS.

23. See Becker (1983), who asserts that non-cooperative competition between pressure groups for political influence favors efficiency.

24. Recall that, from an economic perspective, there is optimal greenhouse gas reduction when the marginal costs of abatement equal the marginal benefits of those measures. How that determination should precisely be done in practice is of course another issue. Not only does it require complicated technical information in order to determine how those costs and benefits should be calculated, the valuation of the benefits may also depend on different preferences and to that extent also include subjective elements. It falls beyond the scope of this article to investigate to what extent the IPCC has reflected on optimal emission-reduction levels in their reports.

25. The government can of course in this respect invite scientists to provide research on this matter, although filling in the subjective elements is usually the prerogative of democratic institutions.

26. For a discussion of the potential role of the ICJ in the field of climate change, see Voigt (2016); for a discussion of the adjudication of climate change matters by various international courts, see Sands (2016).

27. The "Warsaw International Mechanism for Loss and Damage" was initially adopted by a decision of the parties to the UNFCCC *<https://unfccc.int/node/8106>* on its nineteenth session, held in Warsaw November 11–23, 2013, 2/CP.19. In article 8 of the Paris Agreement, parties "recognize the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of loss and damage," While decision 2/CP.19 focuses on developing countries that are particularly vulnerable to the adverse effects of climate change, this specific mention is not made in article 8 of the Paris Agreement.

28. Bodansky (2016, p. 147) also points at the fact that particularly the statement in article 9.1 that finance is related to the *continuation of existing obligations under the Convention* may be interpreted in that it only relates to assistance for reporting activities. Montini (2015, p. 164) observes that the agreement "simply sets up the framework for a future determination of the concrete efforts to be undertaken."

29. On the contrary, in the decision of the parties to the UNFCCC adopting the Paris Agreement, it is stated that "Article 8 of the Agreement does not involve or provide a basis for any liability or compensation."

30. For an elaboration of this issue and of different styles of compliance mechanisms (the "management" school versus the "enforcement" school), see Oberthür (2014).

31. For a discussion including the specificities of the case in view of a national law on implementation of the Kyoto Protocol, see Ugochukwu (2018, pp. 98–102).

32. The flipside of this principle is that states have the sovereign right to exploit their own resources.

33. For an elaboration of a question for an advisory opinion of the ICJ in the field of climate change, see Philippe Sands (2016, p. 25). Sands also observes that the ICJ has "a record on the environment on which it can be proud" (p. 32).

34. Sands (2016, p. 33) foresees that this issue could be submitted to the ICJ by means of a request for an advisory opinion.

35. It is reported *<http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2018/04/Global-trends-in-climate-change-legislation-and-litigation-2018-snapshot-2.pdf>* that there are more than 1,500 climate laws and policies worldwide; 106 have been introduced since the Paris Agreement was reached. A deeper analysis is needed to whether the laws include enforceable emission reduction commitments and/or financial compensation mechanisms.

36. The European Union is the only party to the UNFCCC, the Kyoto Protocol, and the Paris Agreement that is a regional organization. The Paris Agreement (article 4, paragraphs 16, 17, and 18) provides that the EU can act jointly with its member states in preparing, communicating, and maintaining successive nationally determined contributions.

37. In 2018 eight laws were expected to be adopted by the European Parliament and the Council of the European Union, of which some are new (such as a regulation on the governance of the Energy Union, which introduces the obligation for member states to provide a national climate and energy plan) and others introduce a legal framework for a new emissions-reduction period (such as Regulation 2018/842 of May 30, 2018, on binding annual greenhouse gas emission reductions by member states from 2021 to 2030), while yet others amend already existing laws (such as an amendment of the EU emissions trading system by means of Directive 2018/410 to enhance cost-effective emission reductions and low carbon investments).

38. Nonetheless, taken as a whole, the EU has adopted many measures in the field of emission reduction, renewable energy, and energy efficiency. For a discussion of this mix of instruments for the time period 2008–2020, see Peeters (2014).

39. The Massachusetts Supreme Judicial Court, ordering the Department of Environmental Protection of the state of Massachusetts to take regulatory action to reduce GHG emissions in view of the specific state legislation (the Climate Protection and Green Economy Act), found nothing in the statutory language "to indicate that the department must regulate every source of emissions"; hence, the state was deemed to have discretion to select which sources and sectors to regulate (*Isabel Kain & others v Department of Environmental Protection, Commonwealth of Massachusetts*, Supreme Judicial Court, SJC-11961, May 17, 2016).

40. See CJEU (2008, para 57): "The Court acknowledges that . . . the . . . legislature has a broad discretion where its action involves political, economic and social choices and where it is called on to undertake complex assessments and evaluations. . . . In addition, where it is called on to restructure or establish a complex system, it is entitled to have recourse to a step-by-step approach . . . and to proceed in the light of the experience gained." Given this consideration, it is not excluded that the Court, in a future decision, would find that certain yet-unregulated sources have to be included in the regulatory system.

41. Nonetheless, WTO law gives room for environmental measures, even if the aim is to regulate extraterritorial harm. For a call for trade measures (border carbon adjustments), see Mehling, Van Asselt, and Droege (2018).

42. For a critical discussion of the legal argumentation by the court, see Dejong (2013), and for an even more critical discussion from the viewpoint of the effects on Chinese airlines, see Liang and Zhang (2014). For a supportive discussion arguing that the Court could even have gone further in its argumentation for justifying the regulation, see Voigt (2013).

43. Principle 11 reads: "States shall enact effective environmental legislation. Environmental standards, management objectives and priorities should reflect the environmental and developmental context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries."

44. For the financial penalty, see CJEU (2013). In case CJEU (2016), the CJEU annulled a Commission Decision in a technical complex matter; this, however, did not improve the legal positions of the industries (i.e., fewer free allowances allocated to emitters).

45. Article 13 of the Rio Declaration asks states to develop national law regarding liability and compensation for the victims of pollution and other environmental damage.

46. See Directive 2004/35/EC of the European Parliament and of the Council of April 21, 2004, on environmental liability with regard to the prevention and remedying of environmental damage (as amended).

47. Article 4(5) of this directive reads: “This Directive shall only apply to environmental damage or to an imminent threat of such damage caused by pollution of a diffuse character, where it is possible to establish a causal link between the damage and the activities of individual operators.” Article 3 of this directive explains the focus, environmental damage, and its third paragraph reads: “Without prejudice to relevant national legislation, this Directive shall not give private parties a right of compensation as a consequence of environmental damage or of an imminent threat of such damage.”

48. Stone (2010, p. 76) proposes to establish a fund from chargers on emissions that would not only cover damages ex post but would also help prevent damages before they occur.

49. Recall that regulation will not seek the prevention of all damage but will, based on cost-benefit analysis, attempt to establish optimal emission levels. This implies that even when optimal emissions levels have been determined, damage still can take place.

50. See article 10(3) of the EU ETS directive (consolidated version). What funding is exactly obliged is unclear and could be crystallized in an infringement action by the Commission before the Court of Justice of the EU.

51. See Germanwatch *<https://germanwatch.org/de/14577>* for an explanation of this support. Germanwatch does not pay costs related to the court procedure but provides support by publicizing the claim, while the “Stiftung Zukunftsfähigkeit” takes care of costs related to the court procedure.

52. The claim states that approximately 3.5 million euros is needed for measures to prevent the flood; the amount requested from the energy company is 21.000 euros (according to the claim by Germanwatch). Also notice that the amount needed for taking precaution may perhaps be higher than the value of the damage (although we have not studied any calculation on this matter).

53. Decision of the court (the Oberlandesgericht) of Hamm of November 30, 2017, regarding the admissibility of the claim.

54. For an earlier discussion affirming the positive in case the public regulation is not sufficiently protective, see Peeters (2011). On this issue, see paragraph 2 of the decision of the court from November 30, 2017: even when a private actor acts lawfully, liability for damage caused by its acts is, in principle, the case. Taking a broader perspective, it would be interesting to investigate whether the funding created by the state of Germany from the revenues from the EU ETS have been used for financing preventive (adaptation) actions in foreign countries and whether the farmer could have been eligible to receive such funding. However, emissions from fossil fuel generation were exempted from the obligatory auctioning until 2013, so in this respect, the addressed company did not contribute to creating finance under article 10 of the EU ETS directive.

55. Next to tort law claims, human rights procedures may also be started, which in view of the limited space here will not be discussed.

56. As observed by Bouwer (2018, p. 18): “determining the implications of private litigation is a complex and unpredictable process.”

57. Of course, the capacity of a federal US agency can change over time, particularly in view of decisions made by the president of the United States.

58. For a specific elaboration of this issue, starting from the per capita principle, see the Expert Group on Global Climate Obligations (2015).

59. It depends on the national legal system whether a national court will find this argument justiciable (see article 4(3)Paris Agreement).

60. Clearly, systematic comparative legal research has to be carried out on climate change adjucation across the world. For a comparison of selected cases, see Ugochukwu (2018).

61. On judicial activism (and how to qualify whether a judicial decision is activistic, which, in view of the author, is a discussion for citizens of ivory towers) in the field of climate change, see Spier (2010, pp. 426–454), also stating that "it is a matter of taste" whether or not one likes activistic judgments (p. 448). This illustrates the potential normative character that law, including legal scholarship, may take.

62. This is not the case in the International Court of Justice or the Court of Justice of the EU.

63. It was already repeatedly indicated that mentioning that greenhouse gas emissions should reflect "optimal" standards is easy in theory but extremely complicated in practice, whereby especially the question arises to what extent courts are able to exercise this complicated cost-benefit analysis.

64. Such as *Saúl versus RWE*, but also more recently, at EU level, case T-330/18, *Carvalho and Others v Parliament and Council*, lodged on May 23, 2018.

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