Aspects on economic efficiency of the EU environmental liability regime:

A critical survey with reference to the relevant U.S. regime in comparative analysis, under particular consideration of the damage assessment methodology provided for in both systems.

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SCHOOL OF SCIENCE & TECHNOLOGY

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Abstract

The Liability Directive adopted in 2004 by the European Parliament and the Board of Ministers of European Union, constitutes an innovation in comparison with former legislations, as it broadens its scope further than the notion of traditional damage. The fundamental principle that the European liability regime introduces is the polluter pays principle, which sets the economic analysis of the Directive extremely significant. This thesis aims at presenting the aspects on economic efficiency of the liability Directive and the US regime in a comparative analysis and especially stressing the damage assessment methodology which is included in the provisions of both regimes.

An overview of law and economics review is provided in the introductory part of the dissertation, in an endeavor to stress the close connection between these great fields of study. The EU Liability Directive is analyzed in the second chapter of the thesis. The main issue that is examined is whether the Directive is efficient or not; thus its analysis from an economic perspective is imperative. In the last chapter the scrutiny of natural resource damage assessment methodologies takes place. Relative provisions of both the US and EU regimes are analyzed and compared from an economic point of view. In addition, the notion of monetary valuation is highlighted and the prevailing economic valuation techniques are briefly presented and evaluated. Only a few studies have been realized regarding the topic of the third part of the thesis. However, efficiency considerations with respect to environmental damage valuation techniques generate increasing interest among scholars during the last two decades.

Literature references that have been occupied with the present topic to date, are focused only in specific issues, thus a literature review is not possible to be realized in this part of the dissertation; it will take place in several parts of the study though.

This dissertation was written as a part of the MSc in Energy Systems at the International Hellenic University, with supervisor Professor G. Christonaki.

Olga Stylou

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Contents

ABSTRACT ............................................................................................................................... III

CONTENTS ............................................................................................................................. V

1 ECONOMIC ANALYSIS OF LAW- INTRODUCTORY REMARKS ......................... 1

1.1 BASIC PRINCIPLES OF ECONOMIC ANALYSIS OF LAW ............................... 1

1.2 PROPERTY RIGHTS ................................................................................................. 4

1.3 ENVIRONMENTAL DAMAGE AS EXTERNALITY .................................................. 5

1.3.1 Internalization of externalities .............................................................................. 6

1.3.2 The Coase theorem ............................................................................................. 7

1.3.3 Valuing environmental externalities .................................................................... 8

1.4 THE RATIONALE OF TORT REGULATIONS ....................................................... 9

1.4.1 The significance of liability rules ......................................................................... 9

1.5 ENVIRONMENTAL LIABILITY .................................................................................. 11

1.5.1 Avoiding environmental harm I: The price of negligence .................................... 11

1.5.2 Avoiding environmental harm II: Strict liability ................................................ 11

1.5.3 Negligence versus Strict liability ........................................................................ 12

1.6 CONCLUSIONS .......................................................................................................... 13

2 ENVIRONMENTAL LIABILITY DIRECTIVE- AN EFFICIENT REGIME? .... 15

2.1 A BRIEF OVERVIEW OF THE ELD .................................................................. 15

2.1.1 The underlying principles of the Directive ......................................................... 16

2.1.2 The Polluter Pays Principle (PPP) ..................................................................... 16

2.1.3 Subsidiarity, Proportionality and Preventive Principle ...................................... 17

2.1.4 ELD- a liability regime? ..................................................................................... 18

2.1.5 Scope: Compensable damage .............................................................................. 20

2.1.6 Liable operator .................................................................................................. 22

2.1.7 Exemptions from liability ................................................................................... 24

2.1.8 Preventive and Remedial measures .................................................................... 26

2.2 EXCURSUS: US LEGISLATION ......................................................................... 28
2.2.1 Comprehensive Environmental Response Compensation and Liability Act (CERCLA) ................................................................. 28
2.2.2 Oil Pollution Act (OPA) .................................................................................................................. 30
2.2.3 A brief comparison of the US and the EU legislations ............... 31
2.2.4 Access to environmental justice ................................................................. 33

2.3 Further analysis of the ELD, emphasizing the scholarly criticism on efficiency aspects ................................................................. 34

2.3.1 Insolvency and inefficient provisions upon financial guarantees 34
2.3.2 Compulsory Insurance .................................................................................. 36
2.3.3 Comparison with US legislation .................................................................. 39
2.3.4 Causation ........................................................................................................ 40
2.3.5 Causality and Insurance ............................................................................... 42
2.3.6 Retroactivity ..................................................................................................... 43
2.3.7 Extensive introduction of defenses .............................................................. 44
2.3.8 Operation in compliance with an administrative permit ..................... 44
2.3.9 Operation in compliance with the state-of-the-art ......................... 45
2.3.10 Transposition of the ELD ........................................................................ 46

2.4 Proposals for an efficient liability regime .................................................. 48

2.5 Conclusions ........................................................................................................ 49

3 Efficiency considerations with respect to environmental damage valuation techniques in the basic relevant US statutes and perspectives for their utilization by applying the ELD ................................................................. 53

3.1 NRDA Regulations in the US ........................................................................... 53

3.1.1 A brief comparison of NRDA regulations in the US and EU ...... 54

3.2 Introducing the economic value of environmental damage ........................................................................................................ 59

3.2.1 Why valuing the environment? .................................................................. 62

3.3 Cost-benefit analysis (CBA) ........................................................................... 63

3.4 Valuation techniques ........................................................................................ 65

3.4.1 Stated Preferences Methods ....................................................................... 66

3.4.2 Contingent Valuation (CV) ........................................................................ 67

3.4.3 CV in the US ................................................................................................. 68
3.4.4 CV in the ELD: Challenging its receptive openness Directive 2004/35/EC in favor of possible efficiency gains .................................................................69
3.4.5 Revealed Preferences Methods .................................................................70
3.4.6 Hedonic Pricing Method (HPM) .................................................................70
3.4.7 Travel Cost method (TCM) ........................................................................72
3.5 Conclusions ....................................................................................................73

4 Final Conclusions ..............................................................................................77

Bibliography ..........................................................................................................79
1 Economic Analysis of Law- Introductory Remarks

This chapter aims at setting out the definitions of some significant notions. It is meant to provide a useful background for the analysis that will follow.

1.1 Basic principles of economic analysis of law

The economic analysis of law examines the behavior of individuals towards a change in law and tries to find out when a rule or directive maximizes social welfare and economic efficiency. However, in order for the economic analysis to be understood, it is essential that some economic principles and definitions be mentioned.

The economic analysis of law, also known as “law and economics” is an interdisciplinary subject, bringing together two great fields of study. Particularly, it derives from microeconomics and focuses on economic efficiency and welfare maximization. The latter one is a field of study of welfare economics and is based on the individual’s desire to maximize their own welfare. According to the well known English economist Pigou, welfare resides in a man’s state of mind or consciousness, which is made up by satisfaction or utilities. Hence, welfare is determined by the extent to which an individual’s desires are met.

The cornerstone of economic analysis is that resources are finite. Hence, economics seek for these allocation decisions that lead to an efficient distribution of resources, such that the overall social utility is increased. More specifically, “an allocation of resources is said to be efficient if it is not possible to make one or more persons better off without making one or more persons worse off”. This is also known as Pareto efficiency or Pareto Optimality. However, when a change in the initial allocation is realized making one individual better off without leaving another worse off, then Pareto Improvement is being made. In case that all potential Pareto Improvements have been

1 Anna Rita Germani (2004), Environmental Law and Economics in U.S and E.U.: A common ground?
3 A. C. Pigou, The Economics of Welfare (1920), London: Macmillan, Part II
4 V. Pareto (1909), Manuel d’ Economie politique, Paris
made, the allocation is regarded as Pareto efficient. For instance, in case that near a residential area an airport is deemed social optimum to be built, this makes some individuals better off, while hurts others concerned in view of the environmental impact of the problem. In this situation, social benefit may be considered to be greater than social cost, although residents near the airport are thought to be injured, because of the extra noise. However, a Pareto Improvement alternative would compensate the individuals that were harmed, making everyone better off.

Pareto efficiency refers to the notion of allocative efficiency, which is achieved when the distribution of goods and services is optimal by reflecting the preferences of consumers. Assuming a perfect competitive market, total economic welfare is maximized when prices equal marginal cost of production. Prices reflect the consumers’ willingness to pay in order to obtain a certain good or service and equals the marginal utility they get from obtaining that good or service. When this marginal utility equals the marginal cost, optimal distribution is considered to be achieved. According to an alternative formulation, efficiency is the point where the goods are produced by sellers with the lowest cost and that they are consumed by buyers who value them the most.

Assuming that a market economy produces only two goods x,y which are demonstrated at the above graph at the horizontal and vertical axis respectively, the Pareto efficient points are A and B, instead point C is inefficient. A movement from point C to A or B is called Pareto Improvement, as an increase in the amount of good x results in an increase in good y as well.

Perfect competition describes an ideal market with certain characteristics: there are many buyers and sellers who set the price of the product which is homogeneous. In addition, economic agents have access to information and there is perfect mobility of resources. This kind of market is a Pareto efficient market. A stock market might approximate this concept.

Marginal means an additional unit. Marginal cost (MC) is the change in the total cost of production that arises when the quantity produced increases by one unit. Mathematically it is demonstrated as the derivative of total production cost with respect to the level of output. Total cost (TC) equals the variable and fixed costs of production.

N. G. Mankiw (2011), Princials of Economics, South-western Cengage Learning
According to Mankiw an efficient allocation maximizes the total surplus, which is the difference of the buyers’ willingness to pay minus the sellers’ cost of production. Total surplus also equals the consumer plus the producer surplus and demonstrates the total gains from trade in a market. Note
A great part of economics is concerned in avoiding inefficient economic outcomes and formulating policies which boost efficiency. Adam Smith has introduced in his controversial work “The Wealth of Nations” the notion of the invisible hand, which unfolds a great influence for many economists until today. According to Adam Smith, under certain conditions and when a competitive market operates with substantial freedom, then it is able to regulate itself, resulting in the maximization of social welfare. However, when proper conditions are not achieved, because, for instance, of concentrated market power or information asymmetry for instance, markets do not allocate resources efficiently. This phenomenon is called “market failure” and it is characterized by failure of price signals to reflect social costs and benefits in the right way. Thus, government intervention is often considered necessary in order to implement policies which aim to economic efficiency. In addition, a clear definition and implementation of property rights are necessary in order for economic efficiency to be achieved.

The other field being examined by “law and economics” is the reaction of individuals to certain changes in law and especially when incentives are given to them. A detailed analysis of individuals’ behavior can occur from the study of tort law. This branch of law focuses on situations at which some kind of damage is occurred. Liability rules that are most efficient in order to prevent this damage are determined by tort law. For instance, in a situation where there is a factory contaminating a nearby river with industrial chemicals and local people who have to deal with the pollution, the polluter has to compensate the victim according to tort law. This is valid, not merely for the sake of the compensation itself; tort law aims to create an incentive to the polluter to avoid the pollution instead of paying penalties. Given the assumption that individuals are rational, they will respond to the incentives given to them. This is the basic idea of tort law which aims at damage prevention caused by an imposition of more strict penalties, as individuals will react to the increased penalties by limiting their action relevant to the damage generation.

\[\text{that consumer surplus is the buyer’s gain from trading in the market and equals the value that the buyer put on a good minus the amount of money that the buyer actually pays in order to obtain the good. Producer surplus is equal to the amount of money a producer receives by selling a good minus the cost of producing that good.} \]

\[9\text{ A. Smith, (1776), The Wealth of Nations, Book IV, Chapter II}\]

\[10\text{ See subchapter below}\]

\[11\text{ The concise encyclopedia of Economics, Paul H. Rubin, Ed. Online at Library of Economics and Liberty}\]
1.2 Property rights

Equity and efficiency issues are derived from property rights. In any situation where there are conflicting interests between individuals or groups of individuals, law has to determine which of the conflicting parties will prevail. In addition, the state has to make a series of second order decisions, regarding the protection of entitlements or whether an individual is allowed to buy or sell the entitlement. There are three categories of entitlements: those protected by property rules, others by liability rules and inalienable entitlements.  

Economic science refers to property rights as a bundle of entitlements which define the privileges and limitations regarding the use of a resource by the individual owning it. The nature of property rights is characterized by high complexity, however well defined property rights are of high importance, as they constitute an essential human right. An efficient structure of property rights includes three main characteristics, which are exclusivity, transferability and enforceability. The first characteristic implies that all rights and duties are entitled to the owner of the resource, excluding everyone else from using it. Transferability allows the owner to transfer the property rights and these rights should be protected from encroachment by others according to enforceability. According to the Coase Theorem, when individuals have the ability to bargain and rights are transferable with negligent transaction costs, then the definition of property rights is not necessary, as individuals will end up with the most efficient solution by bargaining with each other. In a world that transaction costs are important, the situation changes though.

A controversial issue is whether private or public ownership leads to less economic efficiency, given that the “tragedy of the commons” is a negative result of public ownership. This quotation refers to the depletion of common resources, as a consequence of

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13 T. Tietenberg, L. Lewis, Environmental and Natural Resource Economics (2012), Pearson Ed.


16 See subchapter 1.3.2.

their overexploitation by self-interested individuals and the absence of rules on resources’ use.\(^{18}\) The earth’s atmosphere, fish stocks and ground water are considered to be common goods. They are non excludable, allowing everyone to have access to them and rivalrous, implying increased utility for individuals who use them more. A common measure against this circumstance is state intervention with the aim to define property rights or directly manage the resource.

Regarding environmental issues, there is higher difficulty to determine exact property rights, therefore they are often violated. For instance, when a factory emits smoke and acids in the air over the land owned by another party, it is controversial whether the factory is polluting the land without permission by the owner. Property rights determine the manner in which individuals use environmental resources. When property rights are too difficult to be defined or too costly, then state intervention is realized and environmental laws are created.\(^{19}\)

1.3 Environmental damage as externality

Actual market economies differ from ideal economies, in that they fail to distribute the resources in an efficient manner. This situation is known as “market failure”. One of the sources of externality is the lack of well defined property rights. Many authors claim that externalities derive from all kinds of market failures; however Baumol and Oates have formulated a more specific definition. According to them, an external effect or externality occurs when the activities of an economic agent influence the utility or welfare of another agent in such a way that is unintended and without compensation.\(^{20}\)

In the case that an economic agent’s activity generates negative impact without compensating the affected agents for it, then negative externality has occurred.\(^{21}\) Environmental pollution is considered to be the most severe negative externality. Most environmental externalities are of public variety, which relies on the idea of the jointness of supply, that is using of public goods by multiple individuals. Air pollution for instance,

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\(^{21}\) In the case of positive externality net benefits are produced from an economic activity that make certain groups of individuals better off and without the requirement of monetary payment by them. A nice garden that beautifies the urban scenery in a residential area is considered to be a positive externality.
does not affect only one or a small group of individuals, but victims are jointly affected.  

When an externality is generated by an economic activity, then the society has to bear the negative impact. Thus, the social costs are higher than the private costs. For instance, the acid smoke that emits a factory affects the visage of the surrounding buildings; as a result, the maintenance cost for these buildings will rise. The factory pollutes the air, which is publicly owned, but this activity costs to society and, thus reduces social welfare.

1.3.1 Internalization of externalities

In his study “Some Thoughts on Risk Distributions and the Law of Torts”, which was a milestone in the field of law and economics, Calabresi points out that activities should bear the costs they engender. He stresses that it is a matter of fairness that an industry should pay for the injuries it causes. A solution to the described market distortions would be a system which punishes the generation of harmful effects. In some cases this is achieved with government intervention through pricing or regulation. When an efficient solution is reached in presence of an externality, then it is said that the externality is internalized. This is the aim of tax imposition and liability rules in the case of environmental externalities. A tax internalizes an externality, when it equals the marginal environmental damage. This economic efficient tax is the well-known Pigouvian tax. However, some externalities are not

22 Subhes C. Bhattacharyya (2011), (538)

The diagram demonstrates negative externalities, where the equilibrium output is higher than the social optimum. Markets overprovide the good, thus welfare loss is created, denoting an inefficient resource allocation.


worth to be corrected. After the tax imposition, the polluter has the choice of paying the tax or reducing his pollution level. The final decision is based on the cost-benefit analysis, which will be analyzed in next Chapters of the dissertation.\(^{27}\)

1.3.2 The Coase theorem

Ronald Coase was among the economists who firstly supported the “law and economics” theory. His groundbreaking analysis on “The Problem of Social Cost”, explains that there is an ambiguity on the reason of creation of the externalities and points out the important role of liability rules in internalizing them. He also stresses that taxes and subsidies are the wrong solution in internalizing an externality, as they might lead to misallocation of resources given the reciprocal nature of externalities. \(^{28}\) The Coase Theorem is considered fundamental in analyzing further the role of tort law and establishing efficient legal rules for the prevention of environmental damages.

Coase is using the famous example of the rancher, whose cattle stray into the farmer’s land causing damage to the farmer’s crops, concludes that when transaction costs are negligible, then an economically efficient solution to an externality can be achieved through bargaining. In this case, the initial entitlement of property rights is not important, as the parties will reach the best result by bargaining with each other. In Coase’s example the fence between the rancher’s and the farmer’s land will be eventually build as soon as it costs less than the crop damage. \(^{29}\)

However, Coase’s assumption about zero transaction cost negotiations is unrealistic. In real cases, usually a large number of participants are involved, thus transaction costs might be prohibitive. Big polluters often have the ability to affect easily the negotiation output, as their bargaining power is often greater than that of the victims. Moreover, property rights regarding environmental issues are difficult to be defined; hence there is the possibility of equity distortion. When property rights accrue to an industry, they can be transferred, attracting more industries, thus operating like subsidy\(^{30}\) providing wrong

\(^{27}\) A significant controversy has burst among authors in whether the victims of externalities should be taxed or compensated. However, the taxation of externalities is outside of the scope of this dissertation.


\(^{30}\) Subsidy is a benefit usually in the form of financial support given from the government to certain groups or individuals with the aim of promoting beneficial economic and social outcomes. According to Bhattacharyya, subsidies can be defined as the difference between the price that would exist in
signals to the economy. In other words, bargaining could be often deemed difficult to be successfully achieved. Even in cases that it is deemed necessary liability rules to come into force, the theorem constitute a useful background to the legislator.

1.3.3 Valuing environmental externalities

Environmental resources are unpriced, as they are not traded in markets, they do have value though. As long as human well-being is affected positively or negatively by an environmental externality, there is value that follows this increase or decrease of well-being. This value is necessary to be estimated in order for efficient decisions to be made. Given the above characteristics, in order for a victim to claim monetary compensation for air pollution, pricing of the environmental resource is necessary. However, putting monetary value on this kind of resources is a difficult endeavor.

A wide range of economics-based methods, the so-called valuation techniques are used for this purpose. Many authors claim that environmental policies should be based on cost-benefit analysis, by weighing the costs and benefits of environmental impacts. A crucial question concerning environmental damage evaluation is whether environmental pollution has to be reduced at any costs. These techniques, however, have inflicted controversy among economists and environmental scientists. Firstly, there is ambiguity on whether evaluation methods can provide correct results and secondly, there are ethical issues deriving from the idea of pricing environmental issues. This kind of analysis has various limitations though. Evaluation techniques as well as cost-benefit analysis will be thoroughly examined in next Chapters of this thesis.

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31 Bhattacharyya (2011)
32 M.G. Faure, Environmental Law and Economics (2001), METRO, Maastricht, Netherlands, p 12-17
33 Well-being in economics is used for quantitative methods with the intention to assess the quality of life of a group. See R. Perman, Y. Ma, J. McGilvray and M. Common (2003), Natural Resource and Environmental Economics, Addison-Wesley.
1.4 The rationale of tort regulations

Ronald Coase and the Italian American legal scholar and judge Guido Calabresi were among the pioneers in the field known as law and economics. One of their declarations was that the law could affect the behavior of potential tortfeasors and tort victims.\(^{35}\) Tort law defines the applicable liability rules in case of an accident setting. The economic approach of tort law is based on the idea that a liability rule will give incentives to potential parties of an accident for careful behavior. This approach emphasizes on the deterrence or prevention function of tort law. However, tort law focuses on another function as well, that of compensation.\(^{36}\) More specifically, Accident law gives incentives with the aim of reducing three types of costs, namely primary, secondary and tertiary costs. In the first category accrue the preventive and the costs of the damage occurred. Secondary costs refer to the loss spreading and tertiary costs are those that occur in case of a judicial proceeding.\(^{37,38}\)

This difference in accidents between both approaches is also characterized as an ex ante and ex post vision, where economists tend to focus on the ex ante nature of the accident, whereas lawyers on the ex post vision of the accident. More specifically, economists examine how an ex post liability for damage will influence ex ante the precautionary behavior of potential parties of an accident.\(^{39}\)

1.4.1 The significance of liability rules

Whenever an individual might change the initial entitlement by paying an objectively determined value in order to obtain it, then this entitlement is protected by a liability rule. Hence liability rules involve an additional stage of state intervention. Entitlements

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\(^{38}\) Accidents are distinguished in two types, unilateral and bilateral. In this dissertation only unilateral cases are examined, namely accidents in which only one party, the injurer, can influence the accident risk. This implies that the party which is harmed, the victim, does not influence the possibility of the accident occurrence, neither the gravity of the accident. See K. De Smedt (2008); Shavell (1987)

are not only protected, but also their transfer is allowed if the interested party is willing to pay a certain value determined by the state rather than the parties themselves.\textsuperscript{40}

Liability rules are applicable in situations where one person, the injurer, causes harm to another, the victim. Whether the injurer is liable for the accident and whether he should compensate the victim is defined by the liability rules. In tort law are used two liability rules, the strict liability and negligence.\textsuperscript{41}

Under a strict liability rule the injurer has to compensate the victim in any case, no matter what care he took in each individual case. He has to bear all the costs of the accident. Contrary to this, under a negligence rule, the injurer can avoid liability if he takes the appropriate care, as determined by law or the court.

The basic goal of tort law is the minimization of primary accident costs, which include the precautionary costs and the costs of the expected damage. This implies that the costs of an accident do not only incorporate the damage after the accident has occurred, but also the costs for care made by the potential parties in order to prevent the accident.\textsuperscript{42}

The care level that is deemed appropriate in order to prevent an accident is called “due care”.\textsuperscript{43}

The determination of the optimal due care level is often accomplished with a cost-benefit analysis. The optimal level of precaution, namely where the minimization of accident’s costs take place, is realized at the level where the marginal costs of care taking equals the marginal benefit\textsuperscript{44} in accident reduction. From an economic point of view, given that precaution has a price, liability rules should not give incentives to avoid every accident that could occur, but should imply some weighing of costs and benefits.\textsuperscript{45}

An accident is efficient to be avoided only when marginal costs of precaution are lower than or equal to the marginal benefits of accident reduction.

\textsuperscript{40} See G. Calabresi and A. D. Melamed \textit{Property Rules, Liability Rules and Inalienability: One View of the Cathedral} (1972), Yale Law School, Faculty Scholarship Series. Paper 1983
\textsuperscript{41} K. De Smedt (2008)
\textsuperscript{42} Michael G. Faure, Environmental Law and Economics (2001), METRO
\textsuperscript{43} K. De Smedt (2008)
\textsuperscript{44} Marginal benefit is the additional satisfaction or utility that an individual receives from consuming an additional unit of a good or service.
\textsuperscript{45} Faure (2001). See also Michael G. Faure, Economic Analysis of Environmental Law: An Introduction (2001), IDEP
1.5 Environmental liability

Environmental liability rules provide incentives to the polluters to invest in environmentally friendly technologies or take the optimal care in order to avoid an environmental damage. In this way, through liability rules environmental externalities can be internalized. The analysis of environmental liability follows basically the analysis of tort law.\(^\text{46}\)

1.5.1 Avoiding environmental harm I: The price of negligence

The negligence rule provides incentives to the potential polluter, mainly to the operator of an environmentally relevant installation, to invest in care, in order to reach the optimal standard. The polluter is required to pay compensation only if he spends less on care than the level the legal system has defined as the optimal care standard, known as due care. Thus, incentives are given to the polluters to avoid liability by taking the appropriate care, as this will lead to their utility maximization. For instance, it is efficient for a polluting firm to invest in environmental friendly technology rather than paying penalties for not taking the appropriate ex ante action.\(^\text{47}\)

In case that the polluter invests less on care than the required care level, then precautionary costs will be lower, but he will obliged to pay compensation for the expected damage. Therefore, his total costs will be eventually increased. On the other hand, there is no incentive for the polluter to take more care than the optimal standard the legal system requires him to do, as he can avoid liability by reaching the due care standard. In other words, a negligence rule leads to efficient outcomes, as soon as the care taken by the polluter equals the due care standard.\(^\text{48}\)

1.5.2 Avoiding environmental harm II: Strict liability

The polluter is obliged to bear all the accident costs, including the precaution costs and the costs of the expected damage. A strict liability rule leads to economic efficient outcomes by giving the polluter incentives for optimal care taking, which results in the minimization of total accident costs. If he/she invests less in care than the optimal, then the expected damage will be greater inflicting higher costs, however, if he/she invests

\(^{46}\)K. De Smedt (2008)


\(^{48}\)See M.G.Faure (2001) and K. de Smedt(2008)
more in care his precaution costs will be high enough to lead to an inefficient outcome. Thus, injurers seek for the optimal level of care in order to minimize their total costs.49

1.5.3 Negligence versus Strict liability

It is concluded that in unilateral accidents both negligence and strict liability rules can lead to economic efficient outcomes, by minimizing the primary accident costs. However there are some important differences between the rules which is crucial to be mentioned.

Shavell has devoted a large part of his work in analyzing the activity level that influences the accident risk. He stresses that apart from adopting the optimal level of care, liability rules should give incentives for adopting an optimal activity level as well, which denotes the times that the polluter is involved in environmental risky activity.50 However, activity level is not incorporated in the due care level in negligence rule. Polluters are not held liable if they take the optimal care, consequently there is the possibility to engage in the pollution activity too often. On the other hand, in strict liability the injurer is always liable for the accident, therefore he has to search for the optimal activity level that minimizes his total costs. In this way the externality is internalized, thus strict liability rule might be preferable in case of environmental damages on following grounds.

As far as the compensation is concerned, both rules differ significantly. As already stated, under strict liability all costs accrue to the polluter who has to compensate the victim regardless the care he took. On the contrary, under negligence the polluter has only to comply with the legal standard of due care, which settles the victim to bear the cost of the damage clean-up. However, in this way the cost of the environmental damage does not accrue fully to the liable individual for the accident. Therefore, there might be a preference to opt for a strict liability rule.51

Regarding tertiary costs, namely the administrative and information costs there are some considerable differences too. The information that the court needs in order to determine the optimal care level each time an accident occurs might not be readily available. Thus, negligence rule is characterized by high information costs. In strict liability

49 See M.G.Faure (2001) and K. de Smedt(2008)
51 K. de Smedt (2008)
these costs are borne by the injurer, who is always liable for the accident. According to bibliography, the court might not have always the appropriate information in order to determine the efficient care level, whereas polluting firms seem to obtain the necessary information more readily. This constitutes another argument in favor of strict liability for environmental damages.  

Until this point, it is assumed that the polluter in an environmental accident setting would be able to pay compensation to the victim. However, if the assets of the polluting firm are less than the amount of the damage occurred, the problem of underdeterrence arises in strict liability. This implies that the polluter will only take that level of care which equals the amount to his wealth. Thus, he will only avoid accidents with a magnitude equal his wealth.

1.6 Conclusions

The field known as Law and Economics has established a notable background for decision makers, in order for efficient outcomes to be produced as a result of their policies. Law and Economics has contributed a lot to the field of environmental economics, especially regarding the restoration and compensation of environmental pollution.

One source of environmental pollution lies in the fact that some activities cause negative side effects to third parties. These negative outcomes are caused due to lack of well-defined property rights or due to other kinds of market distortions. Pollution is considered to be a negative externality which causes environmental harm. In this case, prices do not reflect the true cost of goods and services, giving as a consequence wrong price signals to society, which leads to inefficient outcomes. In such situations environmental liability rules come into force. These rules give incentives to the polluters to take under consideration the pollution they are causing. In this way the environmental externality is internalized, which constitutes one of the main goals of the economic analysis of environmental law. So far, environmental liability seems to be in line with the economic analysis of tort law. Between the applicable liability rules, strict liability rule is preferable rather than the negligence in several respects. However, regarding insolvency of the polluter, negligence rule proves to be more effective than strict liability.

52 See K. de Smedt (2008) and Faure (2001)
53 K. de Smedt (2008), Faure (2001)
2 Environmental Liability Directive - an efficient regime?

2.1 A brief overview of the ELD

On 21 April 2004 the Council of Ministers and the European Parliament adopted the Directive 2004/35/EC on Environmental Liability with regard to prevention and remediating of environmental damage, which was on discussion from early 2002. Environmental liability is the mechanism through which the cost of an environmental harm occurred is transferred to whom is responsible for it. Hence, the key point of environmental liability is the assignment of a charge to the environmental damage occurred. The European Directive (2004/35/EC) provides a legal framework for implementing environmental liability and the “polluter pays” principle in the European Union industrial sector.  

The necessity in confronting with environmental damages in Europe has emerged since the 1970s. It is notable to be mentioned that Green Paper and White Paper which were published in 1993 and 2000 respectively constituting significant steps of the EU legislation regarding environmental issues.

The Environmental Liability Directive or ELD, constitutes a common framework among EU Member States which aims at the preventing and the facing certain types of environmental harm caused by polluting firms. Much freedom is given to the Member States though, regarding several aspects of the implementation of the Directive, as described in its provisions. In addition, it is observed that the Directive includes some inaccuracies and omit some crucial matters which merit to be mentioned, as they might lead to inefficient outcomes. Furthermore, it is in the focus of the present study to scrutinize the Directive from an economic point of view, with the aim to deduce whether it contributes to internalizing the external costs.

\[55\] Green Paper on Remedying Environmental Damage, COM(93) 47 final
\[56\] White Paper on environmental liability, COM(2000) 66 final
2.1.1 The underlying principles of the Directive
The fundamental principle that the Liability Directive introduces is the polluter pays principle. Other principles that can be deduced from the objective of the Directive are the proportionality and subsidiarity, as well as the preventive principle, although they are not clearly mentioned in the Directive.

2.1.2 The Polluter Pays Principle (PPP)
The sense of the Principle actually derives from its name, as it means that the person or persons who are responsible for pollution should pay for the costs of cleaning up. It includes an equity notion, as its objective is to protect third parties from paying the cost of pollution in which they did not contributed. The polluter pays principle can be clearly identified in the Preamble, as well as in the first Article of the Directive, where it is clearly mentioned that the Liability Directive is based on this Principle.

The PPP, is essentially an economic principle translated into law. From an economic point of view, polluter pays principle can be examined in terms of efficiency. It is already mentioned that pollution constitutes the more significant environmental externality. PPP aims at internalizing this externality by obliging those causing the pollution to bear the cost of it. In the case of an industrial firm, this cost will be reflected in the price of the product, therefore it will be borne by the producers and consumers of the product, rather than the society. Therefore, prices will rise and as a consequence, ceteris paribus, demand for this product will fall. Consumers’ preferences for lower prices will be an

\[ P_1 \rightarrow P_2 \]

\[ Q_1 \rightarrow Q_2 \]

\[ D_1 \rightarrow D_2 \]

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58 Preambular (2) and (18) of the ELD and Art 174 of EC Treaty, with a different wording though in the latter.
incentive for producers to produce more environmental friendly products. In this way, environmental pollution will be decreased.

However, there is controversy over the efficiency of polluter pays principle, as it is ambiguous whether it does provide help at the policy level and whether the liability should be extended in case the polluter is unable to pay his costs. For answering these complex matters an excursus is appropriate to following three principles which are as well promoted in the ELD.

2.1.3 Subsidiarity, Proportionality and Preventive Principle

The subsidiarity and proportionality principles are introduced in Article 5 (2) of the EC Treaty. According to these provisions, the principle of subsidiarity states that in areas of mixed competencies the Union may take action only if and insofar as the objectives of the proposed action cannot be sufficiently achieved at the level of the Member States and therefore, can be better achieved at the EU level for reasons of scale or effects. Thus, this principle determines whether the Union may take action.

The subsidiary principle is connected to the principle of proportionality, according to which any action by the Union shall not go beyond the inevitable restrictions that are justified by the pursuit of the objective of environmental protection. Thus, when examining measures relating to environmental protection whether adopted at national or Community level, any court needs to perform a two-tier evaluation, known as proportionality test. The first tier examines the suitability of the restrictive measures regarding the objective of environmental protection. The second tier seeks for the potentially less restrictive measures; it gives in other words emphasis on the proportional character of

Since the only variable that changes is price, there is movement along the demand curve, as shown in the diagram above. At P1 price, the quantity demanded is Q1, but when price increases to P2, the quantity demanded decreases to Q2. The diagram is available online at:

Arne Bleeker(2009). See also for a more detailed analysis Nicolas de Sadeleer, Environmental Principles- From Political Slogans to Legal Rules(2002)


K. de Smedt (2008), 164

Also referred as “Community” in the bibliography.

See Article 5 of the EC Treaty


K. de Smedt (2008), 164

See Article 5 par. 3 of the EC Treaty
the measures. This means that the legislative measures should be not less effective in achieving the objective of environmental protection, while the least harmful to other interests and values which are also EU policy objectives.\textsuperscript{68}

The prevention principle was firstly introduced in the Single European Act and is also involved in the European Treaty.\textsuperscript{69} Contrary to the polluter pays principle, it is not mentioned in the Liability Directive however, it is clear that it constitutes one of the objectives of the Directive, as enshrined in Articles 1 and 3.\textsuperscript{70} This principle calls for taking action in order to protect the environment at an early stage, with a view to avoiding damage from occurring rather than repairing it. The preventive character of the principle is formed in Articles 5 and 6 of the Directive. Article 5 stresses the obligation of the operator or the competent authority to take preventive measures before the damage has occurred, with the aim to avoid environmental harm. In Article 6 emphasis is given in the situation after the damage has occurred, where the operator or the competent authority is obliged to take preventive measures in order to avoid the further spread of the environmental harm. Hence, preventive principle encompasses a double function: one function focuses on the environmental damage before it occurs, in order to avoid it and the other after the damage has occurred, in order to avoid it from spreading. Furthermore, in order to prove that prevention is better than cure, it is crucial to be mentioned that the preventive principle complies with environmental economics, as it is much cheaper to invest in preventing an environmental damage rather than restoring it after the accident has occurred, which demonstrates in turn the economic character of the polluter pays principle.\textsuperscript{71}

2.1.4 ELD- a liability regime?

Directive 2004/35 is called a liability Directive. However, it is considered to constitute a different type of liability, as it does not represent the traditional civil liability described

\textsuperscript{68} For a more detailed analysis see Ben Schueler, \textit{Methods of Application of the Proportionality Principle in Environmental Law} (2008), Legal Issues of Economic Integration 35 , 231ff
\textsuperscript{69} Single European Act, 17 Feb. 1986, 1987 OJ (L 169)
in tort law. There is a controversy over what type of liability the Directive follows; it seems that it is, in view of the basic constellation of actors and the tools for administrative action which are made available to the environmental authorities, closer to the administrative law though, combined with private law aspects such as strict and fault-based liability. More specifically, otherwise than civil liability, where a private person is held liable by another private person, whose interests are encroached by the first, in the Directive, the parties involved are the private polluter and the competent authority, namely public authority; hence, the Directive, as a consequence of the US notion of the public trustee moved away from civil law notions by not including physical injury and economic loss, the so-called traditional damage and giving environmental organizations the right to request for action before public authorities in relation to the operator. As Juliane Kokott, involved as an Advocate General at the Court of Justice of the European Union in several environmentally relevant cases brought before the Court, points out, public paw is featured by instruments which remove danger and perform remediation, thus it seems more suitable in confronting in a direct and effective manner environmental damage.

75 J. Kokott, Ökologische Schäden und ihre Bewertung in internationalen, europäischen und nationalen Haftungssystemen – eine juristische und ökonomische Analyse(2003), BERICHTE des Umweltbundesamtes, Erich Schmidt Verlag, Berlin, p.10
76 In view of the above, for some authors the term “liability” in the title of the Directive is inappropriate. Another term that has been suggested instead of the term “liability” is “responsibility”, as it comes of the German law, as well as the definition of the term “legal liability” itself. In view of the above, for some authors the term “liability” in the title of the Directive is inappropriate. Another term that has been suggested instead of the term “liability” is “responsibility”, as it comes of the German law, as well as the definition of the term “legal liability” itself. See also Wood v. Currey, 57 Cal. 209; McElfresh v. Kirkendall, 36 Iowa, 225; and Legal Dictionary|Law.com, available online at: http://dictionary.law.com/Default.aspx?selected=1151
2.1.5 Scope: Compensable damage

Liability Directive as defined in Article 3, aims at remedying and preventing “environmental damage”. The fact that liability is extended to environmental damage as such, regardless any infringements of property rights of the wronged persons, is considered to be a great innovation of the Directive.

“Environmental damage” is defined as “a measurable adverse change in a natural resource or measurable impairment of a natural resource service”. The Directive distinguishes three categories of environmental damage: damage to protected species and natural habitats, water damage and damage affecting land.

Regarding the first category, there are certain exceptions which are considered crucial to be highlighted. Precisely, there is limitation of the damage to protected species and habitats only to those defined under the Habitats and Wild Birds Directives or under equivalent national legislation. These Directives form Natura 2000, according to which in 2009 the protected area covered was approximately only 24% of the Community land area. The criteria on assessing the significance of the adverse effects are set

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77 The ELD was amended through Directive 2006/21/EC on the management of waste from extractive industries, Directive 2009/31/EC on the geological storage of carbon dioxide and amending several directives, and more recently Directive 2013/30/EU on safety of offshore oil and gas operations and amending Directive 2004/35/EC. As a consequence, the scope of strict liability was broadened by adding the management of extractive waste and the operation of storage sites to the list of dangerous occupational activities in Annex III of the ELD, extending the scope of damage to marine waters, respectively.

78 ELD, Article 3 (1): “Environmental damage caused by any of the occupational activities listed in Annex III and to any imminent threat of such damage occurring by reason of any of those activities; Damage to protected species and natural habitats caused by any occupational activities other than those listed in Annex III and to any imminent threat of such damage occurring by reason of any of those activities, whenever the operator has been at fault or negligent”.


80 Article 2 (2) of the ELD

81 Article 2 (1) of the ELD

82 According to Art. 2(1), damage to protected species and natural habitats is “any damage that has significant adverse effects on reaching or maintaining the favorable conservation status of such habitats or species. The significance of such effects is to be assessed with reference to the baseline condition, taking account of the criteria set out in Annex I”. The terms “protected species and habitats”, “favorable conservation status” and “baseline condition” call for further interpretation, therefore they are defined in Article 2 of the ELD, paragraphs 3,4 and 14 respectively.


85 K De Smedt (2008), p.189

out in Annex I of the Liability Directive. Hence, it is obvious that the Directive has
formulated a narrow scope by protecting only certain species and habitats and is based
on pre-existing Community legislation, which is considered to have limited implement-
ation. However, Member States have the possibility to enlarge the scope of the Di-
rective regarding the species and habitats protected, through their national laws.87

Water damage is qualified in relation to the EC Water Framework Directive, as any sig-
nificant adverse effect on water according to the water quality categories defined by the
Directive.88 The liability regime is applicable to land damage only if there is contamina-
tion of land that creates a significant risk to human health.89 Hence, land damage in un-
inhabited areas will fall outside the scope of the Directive.90

Traditional damage, such as damage to the person and property or economic loss, is ex-
cluded from the scope of application of the Directive. This denotes that private parties
do not have right to compensation for damage or imminent threat of damage. In such
cases, compensation will be determined by national rules of civil liability, as Member
States are entitled to enact appropriate measures in order to prevent double recovery
costs.

To conclude, the Directive covers environmental damage to the “natural re-
sources”91 which include protected species and natural habitats, water and land damage.
The protection of species, habitats and water are based on existing Directives, involving
only certain species and habitats and waters.92 This indicates the narrow scope of the
Directive, by protecting only certain species and habitats. Member States do have the
capability to broaden the scope and involve more species under their national legisla-
tion; however this does not boost cross-border harmonization regarding environmental

87 K. De Smedt: “Is Harmonisation always Effective? The Implementation of the Environmental Li-
88 Water damage is “any damage that significantly adversely affects the ecological, chemical and/or
quantitative status and/or ecological potential, as defined in the Directive 2000/60/EC, of the waters
concerned”. (Article 2(1)(b))
89 Damage to land is defined as “significant risk of human health being adversely affected as a result
of the direct or indirect introduction, in, on or under land, of substances, preparations, organisms or
micro-organisms”, Art. 2 par. 1 (c), ELD
90 K De Smedt (2008), p.189
91 Article 2 (12), ELD
92 ELD, Article 2 par. 3 (a), (b): “The species and habitats mentioned in Article 4 (2) of the Directive
79/409/EEC or listed in Annex I thereto or listed in Annexes II and IV to Directive 92/43/EEC; the
habitats or species listed in Annex II to Directive 92/43/EEC and the natural habitats listed in Annex
I to Directive 92/43/EEC and the breeding sites or resting places of the species listed in Annex IV to

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protection, as it promotes disparity among national legislations. In fact, one accident might require that two different regimes shall apply, the Liability Directive and a national or European legislation.\textsuperscript{93} In addition, land is slightly protected, as only contamination of land in case of significant risk of human health falls into the scope of the Directive. This demonstrates the poor subject matter of the Directive regarding soil protection. Land is as important a natural resource as the other categories covered by the liability regime, thus it should be protected not only in case that occurs risk to human health and not only in case of contamination as the type of the damage covered.\textsuperscript{94} Hence, the Liability Directive aims at protecting only three categories of natural resources and not the environment as a whole, ignoring other important natural resources such as air. Thus, the scope of the Directive is considered to be narrow, including inaccurate and perplexing definitions which create an ambiguous background for the environmental protection.

2.1.6 Liable operator

The operator, who caused environmental damage, as mentioned in Article 3 (b) of the Directive, should be held financially liable in order for the polluter pays principle to be accomplished.\textsuperscript{95} The definition of the term “operator” results from a combination of in Article 2, paragraphs (6) and (7).\textsuperscript{96} A significant observation is that the Directive pertain operator duties with regard to the public and not the private interest.\textsuperscript{97}

The Directive distinguishes two liability regimes according to the type of activity of the operator, the strict liability regime and the fault liability regime, as mentioned in Article 3 (1). The strict liability regime applies to those operators whose activities are hazard-

\textsuperscript{93} K De Smedt (2008), p.189
\textsuperscript{95} K De Smedt (2008), p.190
ous or potentially hazardous, as listed in Annex III of the Directive. Under this liability regime all types of environmental damage are covered. On the contrary, the fault based liability applies to operators whose activities are not listed in Annex III and the only type of damage covered is damage to protected species and natural habitats. Liability regimes are clearly demonstrated in the figure below:

Figure 1. Liability Regimes in the ELD (Source: Swiss RE, 2007)

Activities listed in Annex III are considered to be industrial activities, including waste management operations, the discharge of dangerous substances or pollutants into groundwater or surface water, water abstraction and impoundment of water, manufacture, use, storage, processing, filling and release into the environment of dangerous substances and preparations. Moreover, Annex III touches upon transport by road, rail, inland waterways, sea or air of dangerous or polluting goods and use, transport or release of genetically modifies organisms. However, there are other activities, other than the “occupational activities” mentioned above that can cause environmental harm and could be added in the Directive.

Hence, under strict liability, operators are liable only if they conduct the activities listed in the Annex. Then, the entire range of environmental damage is covered. Operators, who are at fault conducting non-Annex III activities, are liable only for biodiversity damage. Consequently, in case that an operator causes damage to biodiversity without

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being at fault or if he causes damage to water or land, the Liability Directive does not apply.\textsuperscript{99} Therefore, the Directive covers only certain activities, which are limited in the “occupational activities” of the Annex. In addition, the fault based liability covers only damage to protected species and habitats, as these species are considered to be particularly exposed and vulnerable.\textsuperscript{100} However, this fact does not justify this provision of the Directive, as the protection of the environmental resources involving water and land are as important as the protection of biodiversity.

2.1.7 Exemptions from liability

The Liability Directive provides for a variety of exemptions from liability, available for the operators. Article 4 of the Directive defines the following cases which are excludable from liability: act of armed conflict and natural phenomena of exceptional, inevitable and irresistible character\textsuperscript{101} and activities which serve national defense or international security.\textsuperscript{102} Maritime disasters,\textsuperscript{103} nuclear risks\textsuperscript{104} and cases which fall within the scope of International Conventions listed in Annex IV,\textsuperscript{105} are also excluded. This last exemption merits more attention. The reason why environmental damage or imminent threat of damage which falls within the scope of International Conventions are not involved in the Liability Directive is that it is considered that these Conventions provide a wider scope of application, as they are implemented worldwide. However, an environmental damage might not have to be restored under an international convention, as these conventions provide limited remediation measures.\textsuperscript{106} Hence, such damage might remain uncompensated or without remediation, as liability regime will not apply for this damage. Moreover, the Directive is applicable “to environmental damage or imminent

\textsuperscript{100}C. Pirotte (2004), A Brief Overview of Directive 2004/35/EC on Environmental Liability, p. 9
\textsuperscript{101}ELD, Art. 4 (1)
\textsuperscript{102}ELD, Art. 4 (6)
\textsuperscript{103}ELD, Art. 4 (3)
\textsuperscript{104}ELD, Art. 4 (4)
\textsuperscript{105}ELD, Art. 4 (2)
threat of damage caused by pollution of a diffuse character only where there is causal link between the damage and the activities of individual operators”. The interpretation of this clause is that only damage caused by widespread activities without a discrete source is covered by the liability regime. Pollution caused by car drivers or households can be considered an example of exemption. In addition, the Directive gives emphasis on the causal link between the negative environmental effect and activities of the operator. Thus, for any damage for which there is not proven causality between the environmental harm and the operator, the so-called “orphan damage”, the liability regime does not apply, the state, therefore, is not obliged to bear the remediation costs. Another clause crucial to be mentioned is that the Directive does not apply to damage occurred before 30 April 2007. To conclude, the entity of these exemptions renders the scope of application of the European liability regime even narrower.

Besides these exemptions, there are two crucial rules which the liability Directive introduces as defenses for the operator, the so called “compliance with permit” and “state-of-the-art defense”. They constitute another exemption of the Directive; however they have been described as a “mitigating factors” clause. According to Article 8, the operator is not obliged to bear the cost of remediation if he is not at fault, if the damage was caused by an activity subject to any permit given under the measures listed in Annex III or if the damage occurred was not considered to cause environmental harm, given the scientific knowledge at the time that the damage occurred. Finally, the implementation-either partial or complete- of this clause is left to the choice of Member States. These defenses have inflicted great controversy, as it is claimed that they undermine the regime of the Directive and weaken national laws of liability. As the basic principle

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107 ELD, Art. 4 (5)
109 ELD, Art 17. More analytically in subchapter below
110 However, the above exemptions are justifiable on the basis of “force majeure”, which is a traditional defense accepted in almost every liability regime. It actually frees the parties from liability in cases that are beyond the control of the parties, such as wars, earthquakes, hurricanes. K. De Smedt describes briefly the function of force majeure: K. De Smedt (2008), p. 225.
111 ELD, Art. 8§4(a)
112 ELD, Art. 8§4(b)
of the Directive is the aforementioned polluter pays principle, according to which liability is imposed on the operator regardless of the case that he is not negligent; the liability regime promotes in other words the strict liability rule. These exemptions are considered to relativize an effective application of this principle, obviously in favor of promotion of market and competition-related considerations. However, they are also said to promote competition in the European industry.

2.1.8 Preventive and Remedial measures

An operator who is aware of an imminent threat of environmental damage is required to take the necessary preventive measures. After taking such action, if the threat remains, the operator should inform the competent authority as soon as possible. Thus, the preventive function of the liability regime is once again emphasized. In addition, the competent authority is expected to instruct the operator in taking the appropriate measures, even to demand that he/she takes these measures. However, in case that the operator cannot be identified or is unable to bear the cost of the preventive measures, then the competent authority is entitled to take the measures itself.

Besides the prevention of environmental damage, Article 6 of the Directive emphasizes on the restoration of the damage, in case that environmental harm finally occurs. The liable operator should inform the competent authority and take the necessary remedial measures in order to limit the damage or avoid further damage from occurring. Similarly to the previous situation described, the competent authority has also comprehensive power over the necessary remedial actions, but it will only take these measures itself as a means of last resort. Annex II provides a common framework for Member States to identify and choose the remedial options available, in order to restore the natural resources. It should be noted that for the selection of the restoration measures the

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115 The European Directive on Environmental Liability —“Polluter Pays”: from principle to practice?, p.32
116 K De Smedt (2008), p. 190
117 ELD, Art 5§1
118 ELD, Art 5§2
119 ELD, Art 5§3
120 ELD, Art 5§4
121 ELD, Art 5§4
122 ELD, Art 6§1, (a), (b)
compatibility with the requirements set by the proportionality principle can be crucial.\textsuperscript{124}

The Annex provides for remediation for the three categories of natural resources covered by the Directive, namely protected species and natural habitats, water and land. Regarding the first two categories, remediation insinuates the return of damaged resources and/or impaired services to baseline condition that is defined as the condition in which these resources or services would have been had the damage not occurred, estimated on the basis of the best information available.\textsuperscript{125} Remediation of land damage implies only the elimination of any significant risk of adversely affecting human health, without requiring return to the baseline condition.\textsuperscript{126}

A scrutiny of Articles 5, 6, 7 and Annex II of the Directive leads to the deduction that the primary purpose of the liability regime is to ensure that the environment will be restored. Monetary compensation is not premised in the provisions of the Directive, in fact it is indicated that regarding “interim losses”, compensatory remediation does not consist of financial compensation to members of the public.\textsuperscript{127} However, when compensatory restoration measures are not possible, alternative valuation techniques, such as monetary valuation may also be used. The main difficulty is that market prices for calculating the amount of compensation are not available. Thus, there are various assessment methods, the most often used of which, are the avoidance-cost approach, the hedonic-price approach and the contingent valuation method.\textsuperscript{128} However, these techniques are limited in their applicability mainly from a legal and insurance point of view.\textsuperscript{129}

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\textsuperscript{125} These definitions are given through the determination of the notions “recovery” and “baseline condition” in Article 2 paragraphs (16) and (15) respectively. See also Annex II paragraph (1)
\textsuperscript{126} Art. 2§15 and Annex II par. (2)
\textsuperscript{128} J. Kokott, A. Klaphake and S. Marr, Key Elements of a Liability Regime Taking into Account Ecological Damage (2005), Journal for European Environmental & Planning Law 2, 277-278; For further analysis see subchapter below.
\textsuperscript{129} See chapter 3 for a detailed analysis of these techniques. See also Kokott, Ökologische Schäden und ihre Bewertung in internationalen,europäischen und nationalen Haftungssystemen– eine juristische und ökonomische Analyse(2003), BERICHTE des Umweltbundesamtes, Erich Schmidt Verlag, Berlin, p.11
\end{flushright}
A significant observation that merits attention is that according to Articles 5 (4) and 6 (3) of the Directive, the competent authority may take preventive and remediation measures itself in case of an orphan damage, but it is not obliged to do so. Hence, there is the possibility that environmental harm not to be restored. These provisions of the Directive can be considered to constitute an opposition to the polluter-pays principle. However, it should be noted that once again the choice is given to the Member States to decide whether they will follow a more strict liability regime by requiring financial guarantees by the operator as indicates Article 8 (2).  

2.2 Excursus: US legislation

In the US federal law the most prominent environmental damage statutes are the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and Oil Pollution Act (OPA). Both statutes are characterized by some differences, as for instance the separate Natural Resource Damage Assessment (NRDA) regulations. However, in-depth analysis of the US legislation statutes falls outside of the scope of this thesis. Only a general background of the US legislation will follow in order to enable a comparison with the principal provisions of the ELD in favour of assessing the efficiency of the latter.

2.2.1 Comprehensive Environmental Response Compensation and Liability Act (CERCLA)

CERCLA of 1980 including Superfund Amendments of 1986 are the first comprehensive statutes addressing environmental liability in the US. CERCLA created a qualified scheme for remedying a release or threatened release of “hazardous substances” into land, air, water and/or endangered species. In addition, the statute established the “Superfund” in order to help the funding of the remediation costs when a financially solvent polluter could not be found. The aim of this fund was to provide for clean-up


It was modeled on a prior extension in §311 of the Clean Water Act that created an oil spill liability program. 42 USC § 9601: “land, fish, wildlife, biota, air, water, ground water, drinking water supplies and other such resources, belonging to, managed by, held in trust by, appertaining to or otherwise are controlled by public entities such as the federal government, state governments or Indian tribes”, are defined as “natural resources”. Both CERCLA and OPA define “natural resources” in the same way, with only some slight differences [CERCLA §101(16); OPA §1001(20)].

The Superfund is characterized as a trust fund and was initially funded through a tax on chemical feedstock, later amended to include a small tax on petroleum, finally expired in 1995 and since has
but not for extended remediation, in cases that the responsible operator could not be found.\textsuperscript{133}

CERCLA contained the provisions of significant importance for the recovery of natural resource damages at that time. Precisely, it contains two innovations that play a fundamental role in the development of a natural resource damage program. Firstly, it authorized the formation of federal, state and tribal officials to act as “trustees” in order to recover damages from injured resources on behalf of the public. Secondly, CERCLA required the federal government to issue regulations identifying the “best available procedures” for assessing natural resource damages.\textsuperscript{134}

US environmental law established strict liability for all kinds of polluters, though this is not explicitly stated in the statute. In addition, retroactive liability is imposed on the polluters by the Act. Furthermore, all operators who contributed to an environmental damage are jointly and severally liable for clean-up costs, which means that in case a polluter is unable to pay the cost of his contribution to the environmental damage, then the other contributors to the injured site are obliged to bear the cost of that polluter too. However, in such a case, the other contributors to the damage occurred will pay more than their fair share of the clean-up expenses.\textsuperscript{135} CERCLA does not provide any specific measure for damage, it implies however, that essential damages might be awarded even if restoration is not always technically possible. Clean-up standards are based on the most restrictive federal standards\textsuperscript{136}. Polluters are expected to remediate sites according to the levels indicated by those strict standards, unless the sites qualify for “brownfield status”. In such a case injured sites will be cleaned up to a lesser degree but only for a certain use, such as commercial property.\textsuperscript{137} Furthermore, the statute states that the damage assessment regulations address direct and indirect injury, destruction or loss, thus shall take into consideration factors including, but not limited to, replacement value, use value and the ability of the ecosystem to recover.\textsuperscript{138}

\textsuperscript{133} Remedial measures EU_US-UKELA, p. 3
\textsuperscript{134} US Environmental Liabilities Statutes. p. 14
\textsuperscript{135} Natural resource damage, p. 2 See also Wetterstein P. (1997),., p. 14-15.
\textsuperscript{136} However, the water-based maximum contaminant levels are considered to be loose, as a result of intense industry lobbying
\textsuperscript{137} N. A. Ashford (2009), p. 3.
\textsuperscript{138} Wetterstein P. (1997), Harm to the environment: the right to compensation and the assessment of damages, Oxford University Press, New York, p. 15.
The Oil Pollution Act of 1990 was passed in the wake of the Exxon Valdez oil spill to consolidate and reform the legislation regarding oil spills and to provide a comprehensive response to oil spills that affect navigable waters.\(^\text{139}\) One of the most important and controversial elements of this Act is that, which refers to the treatment of natural resource damages.\(^\text{140}\) Likewise CERCLA, this statute requires the determination of federal, state and tribal natural resource trustees, but according to its provisions it also allows foreign governments to assert claims for damage to their natural resources.\(^\text{141}\) The Secretary of Commerce, acting through the National Oceanic and Atmospheric Administration (NOAA), as well as the Department of the Interior (DOI) have been the most active of the federal trustees.\(^\text{142}\) The OPA, similarly to CERCLA, established strict liability for polluters, who are also jointly and severally liable for clean-up costs.

The application field of natural resource damages under OPA is considered to be broad. OPA provides that natural resource claims are based on the restoration of public resources and have three basic components. More specifically, the measure of damages is the cost of restoring, rehabilitating, replacing or acquiring the equivalent of the damaged net resources. This procedure constitutes the primary restoration of the injured site. Secondly, the measure of damages is the diminution in value of the natural resources pending recovery of the resource to baseline, which is also known as the interim loss value and it is indemnified through compensatory restoration and lastly, the reasonable cost of assessing those damages.\(^\text{143}\)

\(^\text{140}\) See 33 USC § 2702 (a), (b).
\(^\text{141}\) 33 USC § 2702 (b)(2) (A): Section 1002 (b) points out that recovery among other things is required for ‘damages for injury to, destruction of, loss of or loss of use of, natural resources, including the reasonable costs of assessing the damage, which shall be recoverable by a United States trustee, a State trustee, an Indian tribe trustee or a foreign trustee’. See also US env. Liability statutes, p. 16.
\(^\text{142}\) The NOAA has also developed the NRDA regulations under OPA statute. See US env. Liability statutes,p. 17; Remedial measures EU_US-UKELA, p. 3.
\(^\text{143}\) See 33 USC § 2706 (d)(1). Although Wetterstein claims that while CERCLA provides no specific measure of damages [CERCLA§ 107(f)(1) states that the measurement of NRD shall “not be limited by the sums which can be used to restore or replace the subject natural resources”], OPA provides the measure of damages just mentioned [OPA§ 1006 (d)(1)- (2)], it seems that a similar estimation of damages accrues also to CERCLA. See Wetterstein P. (1997), p. 16, 21; Penn.Natural resource damage, p. 1; UKELA (2007) Remedial measures EU_US, p. 3.
2.2.3 A brief comparison of the US and the EU legislations

European Directive, as well as US statutes aim at establishing a framework of environmental liability based on the polluter-pays principle, to prevent and remedy environmental damage.\textsuperscript{144} Under CERCLA the potential responsible party to bear the cost of cleaning-up an injured site falls into four categories\textsuperscript{145}, while in the ELD the “operator” is held liable when environmental damage is caused due to his activity. The definition of the “operator” under the European Directive seems to be general, even inaccurate in comparison to that under CERCLA. In addition, there is a difference in the provisions of EU and US legislation regarding the natural resources to which clean-up liability applies. Under CERCLA “natural resources” have a substantially broader definition than that of the ELD, consequently clean-up liability is also broadly applied.\textsuperscript{146} However, European law covers a much broader range of activities than the US legislation does, as it also includes the transport of polluting goods and the environmental risk of genetically modified organisms (GMOs).\textsuperscript{147}

Unlike the US statutes, which, as already explained, apply strict liability to all releases of hazardous substances, the ELD provides for two types of liability, namely the strict and negligent liability. Their implementation depends on the nature of the activity associated with the environmental damage caused. Another difference is that the US statutes impose joint and several liability, whereas the ELD does not foresee cost allocation in case that damage is caused by more than one operators. EU Member States shall opt for joint and several or proportionate liability. Another significant difference to be mentioned is that the ELD does not impose retroactive liability, while both US statutes do.\textsuperscript{148} As far as exemptions from liability are concerned, the US legislation includes on-
ly a few, such as act of God, act of war, or act or omission of a third party unrelated to the defendant and an innocent purchaser defense.\textsuperscript{149}

Another element worth to be mentioned is that the European Directive seems to adopt the US notion of the public trustee by empowering the competent authorities to prevent and remedy environmental damage.\textsuperscript{150} A principal difference is that under the ELD competent authorities are not obliged, but only required to take the necessary remedial measures in case that the liable operator cannot be found or is financially incapable of paying the costs of his pollution. On the contrary, in the US it seems that environmental damage hardly is left unabated, even in case of orphan damages.\textsuperscript{151}

A significant difference between the US and EU legislations regarding environmental damage assessment is that in the US all types of environmental damage are treated in the same way. On the contrary, the ELD in case of land damage does not request restoration to its baseline condition, but only the removal of the contaminants from the soil, so that the damage no longer poses a significant risk to human health.\textsuperscript{152}

Another point to be noted is that under all US natural resource damages statutes, the minimum measure of damage is normally the cost of restoring the injured site or acquiring equivalent resources. However, this principal rule was not directly accepted under CERCLA. According to this rule, there are four types of action describing the procedure of the recoverable costs. Firstly, the return of the site to its baseline condition is required. Similarly, the ELD refers to this procedure as primary restoration. Secondly, creating or improving the condition of an alternative site, namely of a resource of the same type, which is geographically linked to the injured site or replacing an injured resource with a substitute resource at the injured site. Respectively, similar provisions are included in the ELD regarding the complementary remediation. Lastly, acquiring similar resources for purposes such as parks and wildlife refuges in order to protect them or

\textsuperscript{149} N. A. Ashford (2009), p. 4.
\textsuperscript{152} See ELD, Annex II (2) and UKELA (2007), Remedial measures EU_US, p. 4.
provide public access. Trustees are free to choose any of these actions, without being obliged to follow an order of priority defined by law.\textsuperscript{153}

2.2.4 Access to environmental justice

In the US citizens are entitled to intervene in government decisions, but also have access to the courts against the authorities.\textsuperscript{154} CERCLA authorizes “any person” who falls into either of two categories defined in section 310 to bring actions against state’s statutory duties. Citizen suits\textsuperscript{155} constitute an important provision both of CERCLA and OPA, as they enforce statutory requirements applicable to government agencies which perform clean-up actions, often referred to in case law as “mandatory duties”. However, this provision seems to be a broad grant to trustee agencies and contain a little action that could be enforceable by citizens against trustees.\textsuperscript{156}

Under the ELD, competent authorities have the predominant role in the implementation of the provisions of the Directive, however, Article 12 entitles natural or legal persons which fall into either of three categories\textsuperscript{157} defined in Article 12 (1), to “submit to the competent authority any observations relating to instances of environmental damage or an imminent threat of such damage of which they are aware and shall be entitled to request the competent authority to take action under this Directive”. The provisions of Article 12 empower non-governmental organizations (NGOs), which are considered to fulfill the two of the three criteria set in paragraph (1) of the same Article, to promote environmental protection. In addition, Article 13 foresees access to the court for third

\textsuperscript{154} N. A. Ashford (2009), p. 4
\textsuperscript{155} Citizen suit provisions, in the USA repeatedly strengthened and expanded in various statutes, have been – as author states - established as an efficient policy instrument and as a participatory mechanism that allows "concerned citizens" to redress environmental pollution, permit environmental groups to seek injunctions, and in some cases penalties payable to the Federal Treasury against alleged violators of environmental laws. See G. Christonakis, Public Interest Litigation for Environmental Damage. Prospects of a Judge Made Environmental Citizen Suit according to the European Developments in the Greek Legal Order and Proposal of a Legislative Regulation, manuscript of a lecture in the Etaireia Dikastikon Meleton, Athens 2006, who develops an option to introduce in the Greek system, in view of the relatively limited coverage of the Directive 2004/35, an environmental citizen suit for claiming compensation for environmental damage parallel to EU liability regime.
\textsuperscript{157} Article 12 (1) of the ELD defines three categories: natural or legal persons (a) affected by environmental damage or (b) having a sufficient interest in environmental decision making relating to the damage or, alternatively (c) alleging the impairment of a right, where administrative procedural law of a Member State requires this as a precondition. The determination of “sufficient interest” and “impairment of right” are to be defined by Member States.
persons defined in Article 12; this decision leads to Europeanization of domestic systems of environmental public interest litigation.\(^{158}\)

2.3 Further analysis of the ELD, emphasizing the scholarly criticism on efficiency aspects

2.3.1 Insolvency and inefficient provisions upon financial guarantees

The problem of insolvency of the polluting firm arises when the cost of the damage occurred is higher than the assets of the firm. As a result, under-compensation of the victims might arise. Furthermore, it might also be possible that a limitation of the compensation is included in the liability legislation, which is called “financial cap”\(^{159}\). In both cases, under a strict liability regime, underdeterrence might arise.\(^{160}\) Therefore, from an economic perspective strict liability regime should not be introduced without financial guarantees, as insolvency risk might arise and consequently, the restoration of environmental damage cannot be insured.\(^{161}\) On the contrary, under a negligence rule the insolvency problem is not that intense. The reason why, is that the polluter will still have an incentive to take the optimal care, as long as the costs of these precaution measures are less than the value of his assets.\(^{162}\)


\(^{159}\) This term is also known as “financial ceiling”. The ceiling threshold approach, which was firstly implemented in the US, actually provides a minimum level of compensation. The necessity for a specified level of compensation arises due to the fact that the cost of remeding environmental damage cannot always be estimated with accuracy, as well as no financial guarantee can provide for unlimited liability. For more information see “Implementation Effectiveness of the Environmental Liability Directive (ELD) and related Financial Security Issues”, p. 33.

\(^{160}\) In this point, a further analysis of the underdeterrence problem is deemed crucial. Given that the financial assets of the operator are limited, he will only take precautionary measures up to the value of his own assets. Thus, the polluter will only take care up to the value of his assets or the financial cap determined by law. In other words, he will not be able to increase his precaution for accidents that may cause higher damage costs than his financial ability or the cap. Consequently, potential pollution will not be fully internalized and pollution costs will be borne by society.


Article 14 of the ELD provides that Member States shall take measures to encourage the development of financial security instruments and markets by the appropriate economic and financial operators, including financial mechanisms in case of insolvency, with the aim of enabling operators to use financial guarantees for covering their responsibilities under this Directive.\textsuperscript{163} However, mandatory insurance is not required by Member States. From an economic point of view, it is regrettable that the Directive does not provide for a certain kind of financial insurance among the Member States yet. Nevertheless, Article 8 (2) which foresees financial guarantees as via security over property for coverage of costs made by authorities might be capable of compensating this deficit in case of an insolvency of operators who have caused the damage or the imminent threat of damage at least to some extent.\textsuperscript{164}

Some national environmental insurance markets have been created, whereby a variation among the States is obvious, as the provisions of the Directive are not binding regarding financial insurance.\textsuperscript{165}

\textsuperscript{163} ELD, Article 14 (1)
\textsuperscript{164} K. De Smedt (2008), p. 233-234
\textsuperscript{165} The following figure (Figure 2) demonstrates the national environmental insurance markets of some indicative Member States, as it was formulated by 2009. A notable observation is that only Germany achieved to proceed to an advanced insurance market only two years after the deadline for the transposition of the ELD to the Member States. Note that the countries referred in the figure are indicative, as they are only those who took part in the below mentioned survey.

![Figure 2. MS assessment of their national environmental insurance market](#)

Still limited action seems to have been taken regarding insurance issues with only eight Member States having adopted mandatory financial security provisions.\textsuperscript{166} Other Member States,\textsuperscript{167} rely on voluntarily financial security.\textsuperscript{168} According to the report of the European Commission in 2010, on the effectiveness of the Directive in terms of actual remediation of environmental damages examining whether the liability regime should be modified\textsuperscript{169}, which was submitted according to Article 14 of the ELD, the action the Member States took is restricted to discussions with insurers. In most cases the national insurance markets are developed at the insurers’ initiative.\textsuperscript{170}

2.3.2 Compulsory Insurance
Compulsory insurance might be a solution to the underdeterrence problem. The duty of a polluter to purchase liability insurance would be a good way to protect victims against the insolvency of the injurer. Obligatory insurance can prove to be beneficial, as it removes the risk from risk-averse persons and thus increases their utility.\textsuperscript{171} Mandatory insurance might assure the implementation of the polluter pays principle, as the liable operator will pay the costs of remediating any environmental damage. However, compulsory insurance might have optimal results only if certain circumstances are avoided. For instance, control of moral hazard, competitiveness of insurance markets and adequate information are some conditions that have to be met.

More specifically, moral hazard is the well-known phenomenon according to which the insured polluter changes his behavior as soon as the risk is removed from him. In other words, the polluter seems to have no incentive for care taking, as with insurance the risk is shift from him to the insurer, who will pay the compensation as well. Faure points out three possible ways in order to control moral hazard. The first one is through monitoring of the insured, the second one through exposing the insured partially to risk and lastly, a

\begin{itemize}
\item These are Bulgaria, Portugal, Spain, Greece, Hungary, Slovakia, Czech Republic and Romania.
\item Such as Finland and Denmmark
\item Faure (2006), p. 197
\end{itemize}
combination of both methods.\textsuperscript{172} Monitoring of the insured seems to prevail though. In order to control moral hazard insurance providers can require that firms invest in a prescribed level of preventive measures. In this way, the insured operators are forced to internalize the costs of their liabilities, since insurance premiums are priced such that they reflect the liability risk that the polluter poses.\textsuperscript{173} The confrontation of the moral hazard is considered to be of great significance, as in the contrary case compulsory insurance proves to be problematic, due to a potential externalization of pollution costs.

It is crucial to be mentioned that the polluter in order to shift the risk from him to the insurer is charged a price or else fair premium. This is defined by the multiplication of the possibility that a certain event will occur with the possible magnitude of the damage.\textsuperscript{174} Of course, this estimation requires accurate information on the likelihood that a certain loss will occur, as well as the potential magnitude of the damage. However, the predictability of liability risk is often difficult to be estimated. Therefore, the injurer is charged with an additional premium the so-called risk premium, to account for this unpredictability. However, the final premium might be attractive or not for the parties involved. Compulsory insurance generally neglects the fact that the demand for insurance may vary according to the individual risk situation, which constitutes a significant omission.\textsuperscript{175}

Another condition for the successful function of the obligatory insurance is the competitiveness of the insurance markets. With the existence of competition the premiums will be adjusted optimally among individuals. Nevertheless, in many countries monopolistic situations prevail, where it is more difficult to control moral hazard problem, thus the outcomes are not characterized by optimality.

Environmental insurance markets are not an experienced branch, as they have been lately introduced. The limited availability of insurance cover for this branch is to a large extent caused by the adverse selection problem; since a minority of companies seeks for insurance, an optimal risk spreading is not possible.\textsuperscript{176} A remedy for adverse selection problem, as well as moral hazard is risk differentiation.

\begin{itemize}
  \item \textsuperscript{172} Faure (2006)
  \item \textsuperscript{173} Faure (2006)
  \item \textsuperscript{174} Faure (2006)
  \item \textsuperscript{175} Faure (2006)
  \item \textsuperscript{176} More specifically, adverse selection problem arises when individuals fail to unveil their true risk profile appropriately. Given that loss spreading is the cornerstone of insurance, the insurer needs a minimum number of similar risks. At the same time the average risk premium in a specific risk pool
\end{itemize}
However, according to Faure, it is ambiguous whether the existing insurance firms are able to differentiate environmental liability risks effectively and control moral hazard problem. In other words, it becomes dependent upon insurers whether they are willing and have the ability to cover a certain risk. Therefore, the implementation of compulsory insurance has triggered controversy among Member States.

On the other hand, according to an overall assessment of the ELD-related insurance market in 2009, the market was described as growing and competitive, that provides good cover for most liabilities under the Directive. The impediment to the growth of this market is not deemed to be the amount of premiums neither the uninsurability of certain risks, but rather the lack of interest from the operators for this certain risk.177 According to the same study, clear guidelines and models are necessary in order to facilitate insurance product development for insurance market, elements which are still restricted to national efforts and might not be applicable to other Member States.

A notable observation worth to be mentioned is the wide range of alternative financial security instruments that are suitable to cover the ELD-related liabilities. However, there is limited knowledge to the Member States and the operators regarding this issue. Surety bonds, letters of credit and trust funds are only some of the alternative financial instruments available in the market. They provide incentives to the operator as soon as the charges are according to his specificities. The selection of the appropriate instrument for each occasion has to be based on the individual particularities of each operator, though these alternatives to insurance are considered to be suitable for large polluting firms rather than small-medium enterprises (SMEs). In addition, their implementation is further limited in times of economic crisis.178 The main limitations of financial security products are the exclusion of gradual environmental damage and exclusion for some types of remediation, such as compensatory. These limitations exist due mainly to lack

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179 Gradual environmental damage is the introduction of financial security when this is realized gradually in the different sectors and risk types that are covered under the ELD. See Report of the European Commission, Brussels, 2010, p. 9.
of data regarding ELD cases and technical support in assessment of losses. As this kind of markets become more experienced, these limitations will be resolved.

According to the report of the European Commission in 2010, the most well-known and often used instrument is insurance. Other instruments also used in the EU are bank guarantees (Austria, Belgium, Cyprus, Czech Republic, the Netherlands, Poland, Spain and UK), funds and bonds (Austria, Belgium, Bulgaria, Cyprus, Poland and Spain) and insurance pools (Spain, France and Italy). 180

2.3.3 Comparison with US legislation

The ELD does not oblige Member States to establish any sort of obligatory insurance or financial security in general, as the Superfund in CERCLA. 181 According to the provisions of the European liability regime, in case “an operator fails to comply with his obligations, cannot be identified or is not required to bear the costs under this Directive, the competent authority may take these measures itself, as a means of last resort” 182. The Directive does encourage the development of such financial security, but it does not include mandatory financial security in its provisions. Hence, it is left upon the choice of the Member States whether they will impose a financial security system or not. Thus, liability varies significantly among Member States. 183 This wide range of different schemes across the EU could lead to a distortion of competition, as operator could choose the countries with the weakest or none insurance standards in order to carry out their activities. 184

The European Commission as well as the EU Member States could learn from the experience of financial security in the US. On the contrary, financial security provisions for environmental liability have been established in the US for over 20 years. The Superfund program has been implemented and enforced financial security regarding the clean-up costs of injured sites. In addition, the Act provides for financial responsibility assurance by polluting firms, setting aside surety bonds or designated funds. 185 Howev-

182 ELD, Art. 6§ 3.
184 The European Directive on Environmental Liability – “Polluter Pays”: from principle to practice?(2004), WWF for a living planet, p. 40
185 Noticable, that such an action was not implemented before May 2009. See T. Munchmeyer, V. Fogleman, L. Mazza, and S. Mudgal have defined that date of implementation about in 2011. See N. A. Ashford (2009), p. 3; T. Munchmeyer, V. Fogleman, L. Mazza, and S. Mudgal (2009), p. 46.
er, some deficiencies have been observed regarding the financial security in the US. These refer to the clean-up costs that were finally borne by tax payers, because the at-risk firms failed to cope with the increased costs of remediating environmental damage.\footnote{T. Munchmeyer, V. Fogleman, L. Mazza, and S. Mudgal (2009), p. 46-47.}

2.3.4 Causation

The economic approach to causation\footnote{The idea of causation of harm can be expressed as follows. Assume that h(s, x) is the harm that occurs in state s if action x is taken, which could denote a level of care taken. For a given state, taking action x may cause harm of h, relative to a reference action (x0). Then, the harm occurred (h) by a certain activity (x) can be demonstrated as h= h(s, x) − h(s, x0). See A M. Polinsky and S. Shavell, \textit{Handbook of Law and Economics} (2007), Vol. 1, eds., Elsevier, 139-182, p.162} is based on the fact that the injurer-polluter should be held liable only for the damage he caused.\footnote{Shavell is among the authors who stresses that causation is of extreme importance. He explains that if there was not causality requirement, the injurers would withdraw from many activities, some of which are beneficial to society, such as manufacturing. In economic terms, the causation requirement avoids the risks of overdeterrence. See Shavell, S., "Uncertainty over causation and the determination of civil liability" (1985), Journal of Law and Economics, 28(3):587-609} However, it is often hard to establish a verifiable causal relationship between the damage and the activity related in case of environmental pollution. Key difficulties in enforcing environmental liability emanates from the existence of causal uncertainty.\footnote{Bartsch Elga goes one step forward and examines the case of causal uncertainty which occurs due to asymmetric information with respect to the precautionary measures taken. For further analysis see Bartsch Elga, \textit{Enforcement of environmental liability in the case of uncertain causality and asymmetric information} (1996), Kiel Working Papers, No. 755 p.11} Law is called to solve this problem. In a situation of uncertain causation, whether a polluter can be held liable depends crucially on the procedural rules regarding the burden of proof. The question of who should be assigned the burden of proof entails substantial incentive effects, which have been collaborated in following scholars’ approaches.\footnote{German Law attempts to alleviate the difficulty of proving causation by reversing the burden of proof. See Bartsch Elga (1996); Cameron McKenna (1995), \textit{Study of Civil Liability Systems for Remediing Environmental Damage}, Final Report, Environment Law Group} According to Van den Bergh, causal uncertainty can stem from two different situations.\footnote{K. De Smedt (2008), p. 217} In the first one there are uncertain victims, whereas in the second one multiple injurers. In other words, in the first situation the damage may have multiple causes, thus it is not clear whether it has occurred due to a single operator only or due to another cause. In the latter situation, it is difficult to be defined which operator has causal relationship with a particular victim.
Much of the bibliography emphasizes to the so-called “probability of causation”, the determination of which can be deemed a fundamental in order to limit the causal uncertainty. Some authors claim that the causation should be equal to the objective marginal product of an activity, being the amount in which the activity has contributed to an increase in the accident risk, although this is difficult to be achieved in practice. In other words, on the basis of statistical evidence the plaintiff should not be liable for the background risk, namely the existing risk, but only for the excess risk, namely the additional risk.\textsuperscript{192}

In order to deal with causal uncertainty, Shavell distinguishes three fundamental legal rules, an all-or-nothing rule, a threshold liability rule and a proportional liability rule.\textsuperscript{193} An all-or-nothing criterion holds that either there is no liability or in case there is liability, then full compensation for the victim is provided. A threshold liability rule is actually a modified version of all-or-nothing rule. Under this rule, a certain threshold is set by law regarding the probability that the damage was caused by the injurer. If this probability is higher than this threshold, then compensation is rewarded. However, when the probability of causation falls under the threshold, then the diminished burden of liability leads to reduced care taken by the operator. On the other hand, when the probability exceeds the threshold, operator will face an extra burden, thus he will invest too much in care. Hence, threshold liability rule cannot generate politically desired incentives in terms of efficient environmental protection. Under a proportional liability rule, the probability of causing the damage is expressed as a right to claim compensation proportional to the damage. In respect of both the injurers and the victims this rule seems to be preferable, as the injurer is required to compensate only for the proportion of the damage he caused and the victim receives compensation if the causality with the damage is proven. Hence, from an economic point of view, the majority of the authors agree that the proportional liability rule is most efficient and results in socially ideal behavior.\textsuperscript{194}

\textsuperscript{192} Faure (2001), p. 97-98; Shavell (1985)
\textsuperscript{193} Proportional liability rule may take several forms such as “proportional damage recovery”, “proportional risk recovery” and “insurance fund proportional risk recovery”. However, further analysis of proportional liability rule is outside of the scope of this dissertation.


\textsuperscript{194} However, David Fischer, an opponent of the proportional rule, claims that the use of tort liability in multiple cause cases involving statistical evidence, serves the policy of deterrence quite poorly, due to the so-called “probability paradox”. This paradox is a characteristic inherent in statistical evi-
Tort law tends to follow such approaches that protect the victim, with respect to causation uncertainty. This means that in some cases full scientific proof of causal relationship is not demanded from the victim, whereas in other cases a reversal burden of proof occurs. Another approach which is used in case of uncertainty due to multiple injurers is to hold several tortfeasors jointly and severally liable.

As far as the Liability Directive is concerned, it could be characterized rather vague regarding causation; however, causality requirement can be deducted from its scope. Article 3 states that in order for the liability regime to apply, a link between the environmental damage or imminent threat of such damage and the occupational activities of the Annex is necessary. Furthermore, Article 4 (5) is the only point of the Directive where it is clearly stated that in case of diffuse pollution, a causal link between the damage and the activities of individual operators is necessary. In case of a multiple party causation, Member States are responsible to decide the cost of remedying that damage. Nevertheless, there is no reference regarding causation requirement in the provisions for preventive and remedial measures, although it can be deducted from the general notion and the scope of the Directive. As many other matters, the Directive gives freedom to the Member States on whether they will adopt more stringent provisions regarding the prevention and remedying of environmental damage.

2.3.5 Causality and Insurance

From an economic point of view, shifting the risk of causal uncertainty or a reversal of the burden of proof to the injurer might have negative consequences for the insurability of risks. Precisely, as the risk is shifted to the injurers, it is indirectly shifted to the insurers as well. Hence, a polluter might be required to compensate a victim fully for a damage for which he/she was not fully responsible himself/herself. However, under a proportionality rule the insured firm will only compensate for the damage it actually caused. Generally speaking, the tendency to provide protection to the victim through the

dence and arises because probability is a relative concept, varying as background risk change. As a result, tort law induces individuals to use less care as the environment becomes more dangerous. Furthermore, switching to proportional liability may not produce heightened overall deterrence. For a more detailed discussion see: David A. Fischer, Proportional Liability: Statistical Evidence and the Probability Paradox (1993), 46 Vand. L. Rev. 1201

K. De Smedt (2008), p. 218

K. De Smedt (2008), p. 222-225

ELD, Article 9

ELD, Article 16

K. De Smedt (2008), p. 218
approaches described proves to be more problematic than the shift towards strict liability.\(^{200}\)

2.3.6 Retroactivity

In environmental liability there is often observed a time lapse between the negative environmental outcome and the time that the damage occurred. This might emanates from the fact that the risks of the damage are not always fully recognized, due to lack of scientific knowledge at the time of the damage, for instance. This fact has triggered a debate on whether liability rules should be applied in a retroactive manner or not, because a retroactive application of liability rules seems to contradict to the impact of these rules efficiency terms.\(^{201}\) As far as the ELD is concerned, it does not have a retroactive effect, as it is applicable only to damage occurred after a certain time threshold, defined to be 30April 2007.\(^{202}\) In case that retroactivity is applied, a polluter is held liable for damage that occurred in the past, which was not considered wrongful given the available scientific information at that time. However, in this way wrong incentives regarding damage prevention are provided to the polluter, as retroactivity does not follow the cornerstone of tort law, which is providing incentives to the polluter in order to prevent damage from occurring or remedy the damage if it eventually occurs. In other words, a foresight for ex post liability gives incentives for ex ante taking preventive action.\(^{203}\)

Furthermore, from an economic perspective, the investment on care taken before the damage occurred is considered to be a “sunk cost”\(^{204}\), which have already been occurred and cannot be recovered. Sunk costs are retrospective costs, thus the fact that care was not taken in a sufficient level cannot change.

More importantly, new risks usually emerge with time, thus due care standard should also be adapted. For instance, technological improvement might cause an increase in care standard. Therefore information about new risks or else development risks is deemed to be crucial. According this and regarding to Faure, a liability regime on de-

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\(^{200}\) Faure (2001), p. 135-143
\(^{201}\) Faure(2001); De Smedt (2008)
\(^{202}\) This is deducted from a combination of Articles 17 and 19(1) of the ELD. However, there are two exceptions described in Article 17. The first one refers to any damage that is identifiable after the certain date mentioned above but due to a polluting activity which took place and finished before that date. The second exception refers to any accident that caused environmental damage and took place more than 30 years ago.
\(^{203}\) Faure(2001); De Smedt(2008)
\(^{204}\) Charle Pirotte refers to them as “past burdens”.

-43-
velopment risks could be efficient, as it could generate incentives to the operators to seek information about new risk and thus preventing environmental damage.205

Hence, the Directive follows the economic analysis of tort law and proves to be efficient regarding retroactivity. However, according to Article 16 the final decision for more stringent measures is left again upon the Member States.

2.3.7 Extensive introduction of defenses
As it is already mentioned, the ELD provides for two kinds of defenses available to the polluters: the permit defense and the state-of-the-art-defense, as described in Article 8 (4) of the Directive. A more thorough analysis is deemed necessary in view of the importance of the defenses from an economic analysis standpoint

2.3.8 Operation in compliance with an administrative permit
The question regarding compliance in the context of a permit defense is activated when the operator demonstrates that he is not negligent, hence has taken the due care measures, as the environmental damage is caused by “an emission or event expressly authorized by and fully in accordance with the conditions of, an authorization conferred by or given under applicable national laws and regulations which implement the EU Directives that are listed in Annex III.206

The introduction of a regulatory compliance defense in the Directive has triggered controversy among scholars. Some reasons why, are successfully scrutinized by Kristel De Smedt;207 Here, a short overview will be demonstrated. To start with, a complete permit defense does not give incentives to the polluter to take precaution in excess of the regulatory standard. Thus, it is considered that it provides minimal protection for environmental damage.208 One characteristic that triggers ambiguity over the permit defense is the difficulty in obtaining information about the determination of the due care level. For industries it is easier to obtain the necessary information rather than courts, but usually there are no incentives for them to do so. In addition, permit defense triggers impartiality issues, as regulators in legal (administrative) and/or political procedures are often un-

205 Nevertheless, there is ambiguity on which strategy is most efficient to be adopted in case that an operator has to deal with a new standard set by regulation, See De Smedt (2008)
206 ELD, Article 8 (4) (a).
208 See also C. Pirotte (2004), A Brief Overview of the Directive 2004/35/CE on Environmental Liability, p. 3
der pressure and lobbying from several interest groups during the decision-making process. For the above reasons mentioned, the economic theory on tort law indicates that a regulatory compliance defense is counterproductive; thus, for several scholars the permit defense might undermine the ability of the Directive to ensure prevention and restoration of environmental damage. On the other hand, Bergkamp argues that without a permit defense inefficiency would occur, as the polluter would be charged twice: once to comply with the care standard and once for the damage caused despite the measures he took.\textsuperscript{209} On the contrary, environmental groups are opponents to the permit defense, as they claim that polluters can be easily exempted from liability, which opposes to the polluter-pays principle. However, defenses of Article 8 have been characterized as a “mitigating factors” clause, which aims at reducing compensation payable by polluting firms.\textsuperscript{210} Moreover, in cases that permit defense exempts operators from restoration of the damage, the Directive lays responsible the Member States for the clean-up of the damage, the implementation of which entails obstacles and leads to ambiguity though. From another point of view, Article 8 (4) of the Directive includes a rather narrow defense, as the burden of proof lays with the operator. In other words, it is the operator, who has to prove that the damage caused was not due to his activity.

2.3.9 Operation in compliance with the state-of-the-art

Article 8 (4) also defines the state-of-the-art defense, which constitutes an exemption from liability when the operator proves that his activities were not considered to cause environmental harm, given the scientific information available at the time that the damage occurred. Precisely, as pointed out in paragraph (b) the state-of-the-art defense is activated when “an emission or an activity or any manner of using a product in the course of an activity which the operator demonstrates was not considered likely to cause environmental damage according to the state of scientific and technical knowledge at the time when the emission was released or the activity took place”.

Similarly with the regulatory compliance defense, the Directive leaves to Member States the final choice upon including this defense into national laws. In addition, also in this case the Directive did not succeed in drafting an exception being in line with an

\textsuperscript{209} K. De Smedt(2008), p. 228; Bergkamp 2001a, p. 65

\textsuperscript{210} See also The European Directive on Environmental Liability –“Polluter Pays”: from principle to practice?An Environmental NGO commentary on the Environmental Liability Directive: its adoption at EU level and what it means for the future, June 2004, WWF for a living planet p. 32
economic analysis approach. As it is already analyzed, liability for development risk might give incentives to the operator to obtain information on new risks and the optimal precautionary measures that might be taken to prevent the risk, as soon as it does not turn into a retro-active liability regime. However, Article 8 of the Directive exempts the operator from liability for development risk, which might lead to inefficient outcomes.

2.3.10 Transposition of the ELD
The deadline for the transposition of the ELD to the Member States was set on 30 April 2007, though transposition of the ELD was completed by the last Member State not before July 2010. Existing national legislation had to be adjusted and developed according to the provisions of the Directive, a procedure which delayed in some Member States. Therefore, little practical experience is available regarding the implementation of the liability regime among the Member States. As it is already underlined, ELD gives the option to the Member States to decide whether they will impose stricter liability leg-

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211 See subchapter above and K.De Smedt (2008), p. 231-232
212 The table below provides a general picture of the defense options as they were transposed by Member States till 2009. It is observed that most states have adopted both state of the art and permit defense, instead only six denied the implementation of both defenses.

Table 1. ELD defense options in MS transpositions

<table>
<thead>
<tr>
<th>Both defences accepted</th>
<th>No defences accepted</th>
<th>SOA defence only accepted</th>
<th>Permit defence only accepted</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium (Flanders, Walloon, Brussels regions)</td>
<td>Belgium (Federal State)</td>
<td>France</td>
<td>Denmark</td>
<td>Netherlands(^a)</td>
</tr>
<tr>
<td>Cyprus</td>
<td>Bulgaria</td>
<td></td>
<td></td>
<td>Lithuania</td>
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<tr>
<td>Czech Republic(^b)</td>
<td>Germany</td>
<td></td>
<td></td>
<td>Sweden(^b)</td>
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<tr>
<td>Estonia</td>
<td>Hungary</td>
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</tbody>
</table>

islation. Hence, some differences are observed in the implementation of the Directive among the States, mainly regarding the defense options and financial security issues.

The mechanism for transposing the ELD varies widely among Member States. In some States the legislative transposition procedures are lengthy and complicated whereas in others it are shorter and more simple. In addition, the imprecise language of the Directive in some provisions has lead to a variety of interpretations by Member States. For instance, some cases reported refer to ambiguity over the definition of “operator”, “permit defense” and “natural resource services”.

As it is observed in the statistical analysis that follows (Figure 3), which is based on the results of the Member States consultation, there is variety of options provided for the Directive that Member States decided to implement in their national legislation. The majority of Member States have extended the biodiversity scope beyond what the Directive foresees. Only the minority of the States has adopted strict liability for non Annex III activities and mandatory financial security. A notable feature worth to mention is the absence of state-of-the-art and/or permit defense from some national legislations. However, as it is already noted, according to the final report of the Commission in November 2009 many states had already accepted both defenses in their legislation.

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214 For instance, in many States the ELD was transposed by primary legislation, which in some cases was accompanied by a Decree or Ordinance. In other Member States including Greece, there was a Single Act, Decree, Government Ordinance or set of Regulations. Pure stand-alone legislation and amendments to the existing legislation were also adopted by some Member States. See BIO Intelligence Service (2013), Implementation Challenges and Obstacles of the Environmental Liability Directive, Final report prepared for European Commission- DG Environment. In collaboration with Stevens & Bolton LLP, p. 24-25.


216 See subchapter above.
2.4 Proposals for an efficient liability regime

The implementation of the ELD is hindered by some fundamental obstacles, which have to be surpassed in order for an effective application of the Directive across the Member States to be realized.

The variation of the national legislations and the different interpretations that Member States have attributed to several provisions of the Directive create difficulties in the implementation of the ELD. Therefore, interpretation guidance to the competent authorities and the operators as well would be necessary in order for some definitions and issues that the Directive could be characterized as vague or confusing. Some key definitions and concepts which need further explanation include for instance, “environmental damage”, “significant damage”, and “baseline condition”. The interpretation support could be realized through informative documents, workshops, seminars or online support through expertise websites.

Moreover, the fact that many Member States did not follow the three-year transposition deadline set by the Directive, but prolonged the transpositions period, has as a result the existence of limited ELD cases to be taken as examples and consequently, stakehold-

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ers\textsuperscript{218} are unaware of the ELD cases identified and are often unaware of their legal obligations and rights too. Thus, raising awareness efforts as well as recording of the ELD cases is crucial to be realized. Raising awareness actions include conferences, seminars, informative documents and information through special websites. Furthermore, Member States should keep records of ELD cases, which can be used as experience on how in terms of best practices to apply the Directive and support the stakeholders. Online submission systems for the notification of cases of environmental damages are already available in some Member States. In addition, technical support to the competent authorities especially regarding the economic valuation techniques, are of high importance.

Financial security sector is also characterized of unawareness by both competent authorities and operators. Another problem this sector faces is that divergent national transposing rules have created difficulties in the implementation of financial security. This wide range of different schemes across the EU could lead to a distortion of competition, as operators could choose the countries with the weakest or none insurance standards in order to carry out their activities.\textsuperscript{219} In addition, financial security providers have to modify their insurance products in order to fit to the requirements of each Member State. The unawareness of stakeholders regarding insurance issues deteriorates the effective implementation of financial security. Therefore, tools and measures that promote information exchange and communication among stakeholders will facilitate the implementation of the Directive.\textsuperscript{220} Regarding natural resource damage assessment, proposals will be submitted in a separate chapter of this study with means of a comparative analysis of Annex II and US normatively established assessment techniques.

2.5 Conclusions

The ELD aims at the prevention and remediation of environmental damages and it is featured by the polluter-pays principle. The Directive establishes a liability system in the form of administrative mechanisms, thus deserves to include the term “liability”. The Directive establishes only a form of minimum protection for the environment and it

\textsuperscript{218} Stakeholders are considered to be all involved parties, such as competent authorities, operators, financial security providers, NGOs, the European Commission, etc.
\textsuperscript{219} WWF, p. 40
\textsuperscript{220} For more details on measures to be implemented for a more effective application of the ELD and tools that already have being implemented in several Member States see the Report of the European Commission, Brussels, 2010 and BIO Intelligence Service (2013), p. 137-142.
is left upon the Member States whether they will adopt more stringent provisions or not. Thus, ELD is perceived to have a narrow scope of application with many optional provisions regarding significant issues such as the scope of biodiversity, the mandatory financial security and defenses from liability, which are left upon the discretion of Member States. Moreover, some significant definitions and issues are described with vague wording, which generates confusion and difficulties in the implementation of the Directive. ELD does not aim at harmonizing fully national legislations, hence there is a variety on the provisions of the Directive that Member States decided to transpose to their national laws. Of course, the transposition and implementation of the Directive encountered obstacles, the most important of which were the integration to national laws, the uncertainties in the text of the Directive and the fact that several issues are left in the discretion of the Member States. In order for the ambiguity regarding whether the ELD is an effective liability regime to be dissolved, some guidance to the Member States, as well as informative and supportive measures for several significant issues of the ELD shall be consolidated.

The US legislature has consolidated two fundamental environmental damage statutes in order to deal with the contamination of natural resources. The US legislation seems to outmatch in the whole the European Directive, as it promotes a more circumstantial and accurate legislative frame. Many provisions of the ELD have been based on those of CERCLA and/or OPA, especially regarding issues for which the US disposes long time experience, such as financial security. However, the ELD covers a broader activity spectrum, while the US law is limited to the protection of natural resources from contamination, for a wide range of natural resources though. Moreover, the US legislation is inferior to the ELD in that the US statutes are characterized by retroactivity, which is not in line with economic theory and it undermines the polluter-pays principle, on which both legislations are based. The ELD has also been influenced by the US notion of the public trustees by empowering the competent authorities to prevent and remedy environmental damages. Furthermore, wide access to courts is given to the NGOs. In the EU such power is mainly given to the NGOs, it is considered to be weaker though. Importantly, the US statutes provide for obligatory financial security for the polluters, unlike ELD. Regarding this issue, the EU has a lot to learn from the US long time experience. As far as the assessment of environmental damage is concerned, two approaches are included in the legislations, namely the restoration cost and the economic valuation techniques. The latter is used for the assessment of monetary compensation due to harm
to environmental goods that have no market price, which has triggered intense controversy, as it will be indicated in the following chapter.
3 Efficiency considerations with respect to environmental damage valuation techniques in the basic relevant US statutes and perspectives for their utilization by applying the ELD

ELD provisions seem to have been based on the US legislation in respect to the NRDA regulations. This influence will be examined in this last Chapter of the thesis in order for present and future prospects of the most prevailing valuation techniques to be identified.

3.1 NRDA regulations in the US

NRDA is a normative regulation which incorporates some quantitative evaluation of injury to natural resources resulting from a discharge of oil or release of hazardous substances. These damages are compensable; to the enforcement of NRDA provisions several of legislative authorities are competent.221

Precisely, Ohio v U.S. Department of the Interior, of the Supreme Court of US, of 1989222 has set the background for the estimation of cost in environmental damage assessment, the compensability of non-use values as well as the recognition of Contingent Valuation as the prevailing though controversial method for valuing non-market environmental goods and services. In the wake of Ohio decision, both CERCLA and OPA developed their provisions regarding valuation methods NRDA.223 The currently available NRDA regulations provide detailed procedures for conducting assessments; these are, however, not binding to Trustees.224 Although, Trustees tend to follow these regulations in order to have a rebuttable presumption for the assessment. Two types of regulations for NRDA procedures have been promulgated: Type A rules which apply to relatively small loses and Type B rules which apply to more important incidents. A typical

222 See 880 F. 2d 432, DC 1989.
NRDA process is conducted in four phases: Preassessment Screening, Preparation of an Assessment Plan, the Assessment Phase and a Post Assessment Phase.\textsuperscript{225} Ohio affirmed a substantial portion of the original regulations promulgated by US Department of Interior (DOI), however, some restrictive provisions such as the hierarchy of resource valuation measures and the “lesser-of” rule for measuring damages were reconsidered and finally rejected.\textsuperscript{226} To date, CERCLA provides for several valuation techniques, including contingent valuation, hedonic pricing and travel cost method and determines the suitable monetary method.\textsuperscript{227} Another significant provision to point out is that current regulations define the measure of damages as such, so as to include total lost value due to the injuries, including both use and non-use values.\textsuperscript{228}

OPA provides only some general directions regarding evaluation methodology, but it includes several references to service-to-service, resource-to-resource, value-to-cost and value-to-value methods.\textsuperscript{229} Unlike CERCLA, under OPA the selection of the most appropriate valuation method is left to the discretion of the Trustee.\textsuperscript{230}

3.1.1 A brief comparison of NRDA regulations in the US and EU

Two main approaches have been developed in the US statutes with the aim to evaluate natural resource damages: economic valuation techniques and the use of the cost of replacing an environmental service as a proxy for its value. Annex II of the ELD favors the second approach.\textsuperscript{231} In the US, the NOAA has developed an analytical tool, the so-called Habitat Equivalency Analysis (HEA) in order to support the restoration cost approach.\textsuperscript{232} Annex II requires the use of resource-to-resource or service-to-service equivalence approaches in order for the scale of complementary and compensatory remedial


\textsuperscript{226} C. A. Jones, Use of Non-market Valuation Methods in the Courtroom: Recent Affirmative Precedents in Natural Resource Damage Assessments, formerly Chief, Resource Valuation Branch, Damage Assessment Center, NOAA, p. 14

\textsuperscript{227} CERCLA §11.80.

\textsuperscript{228} CERCLA §11.80; CERCLA §11.13 (e).

\textsuperscript{229} OPA §990.53; OPA §990.27.

\textsuperscript{230} OPA §990.27.

\textsuperscript{231} UKELA(2007), Remedial measures EU_US, p. 8.

\textsuperscript{232} HEA provides an analytical framework for estimating how much restoration is needed to compensate for the interim loss. It estimates directly the type and scale of the restoration without directly valuing the interim loss in economic terms. For more detail see Ukela, Remedial measures EU_US, p. 10-11; P. Wetterstein (1997) , p. 23.
measures to be determined. When it is not possible to implement these approaches, alternative valuation techniques shall be used, such as monetary valuation. These provisions seem to concur with the respective provisions of OPA.

Both OPA and ELD require that when evaluating compensatory restoration, actions that provide natural resources and/or services of the same type, quality and quantity as those damaged shall be considered first. If compensatory actions of the same type and quality cannot provide a reasonable range of alternatives, then actions that provide natural resources and services of comparable type and quality as those provided by the injured natural resources should be considered. After identifying the types of restoration actions that will be considered, the appropriate approach to determining the size of compensatory restoration is to be defined. Note that the size of compensatory restoration should equal the value of interim losses due to the accident. The major approach for determining compensatory restoration according to the US and EU legislation is service-to-service or resource-to-resource, which requires that the injured and restored site be of the same type, quality and comparable value, so as no explicit valuation to be necessary. The cornerstone of this approach is that the extent of compensatory remediation should equal the value of interim losses, as shown in Figure 4.

![Figure 4. Graphical Depiction of Service-to-Service Restoration Scaling](image)

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233 See ELD, Annex II (1.2.2), (1.2.3).
234 See T. Penn (2001), A Summary of the Natural Resource Damage Assessment Regulations under the United States Oil Pollution Act, p. 4-5.
When the injured and restored resources and services are not of the same type, quality and value, then valuation approach comes into force according to OPA provisions. This approach estimates the value of gains from the proposed restoration actions and the value of interim losses. Some well-known methods used to estimate these values are the travel-cost method, the hedonic price model and the contingent valuation (CV). The latter has been implemented broadly under CERCLA, as well as the Commission has expressed an interest in the use of CV method under the NOAA regulations. However, the ELD only foresees such methods in a general framework in its provisions. Annex II refers generally to monetary valuation for the determination of complementary and compensatory remedial measures, but it does not specify further the meaning of this clause. The operator and the competent authority might agree on the most appropriate method for assessing environmental damage, though it would be helpful to have some guidance on this issue. It is likely that Cost-benefit analysis (CBA), which features prominently in the literature regarding NRDA, will be a useful tool in order for Annex II provisions to be applied effectively in practice, though such a proposal is not included in the ELD.

The general goal of restoration, as specified by damage assessment regulations under CERCLA and OPA, is the return of the injured site to “baseline”, which is defined as “conditions that would have existed at the assessment area had the discharge of oil or the release of a hazardous substance under investigation not occurred”. Likewise, the ELD defines as such the goal of remediation, giving a similar definition for baseline conditions, however, its provisions are considered to be less restrictive, as it has introduced the potentiality of compensatory restoration. In terms of economic analysis, this provision promotes efficiency, as it can be used only when benefits exceed costs.

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237 See ELD, Art 2, 16 and Annex II
238 Remediation measures EU_US- UKELA, p. 16, available online at: http://www.ukela.org/content/doclib/81.pdf
240 See ELD, Annex II (1) and Article 2 (14).
On the other hand, inefficiencies are possible, if lower restoration cost would have been suitable to completely compensate for the damage.\textsuperscript{241}

A far as the definition of interim losses are concerned, both US and EU legislations seem to concur.\textsuperscript{242} Figure 5 demonstrates two different options in order for a damaged natural resource to reach baseline level. The first path shows the situation in which active primary restoration is taken. In this case, the benefit gained is shown in area B. Area A demonstrates the interim loss which is realized due to the damage occurred and needs compensatory remediation. The second path shows the situation in which no primary remediation action is taken, thus more time is needed in order for the injured site to return to its baseline condition. In this case, area A and B represents the extent of the interim losses.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{graph.png}
\caption{Graphical Representation of Primary Restoration and Interim Losses\textsuperscript{243}}
\end{figure}

\textsuperscript{241} R. E. Unsworth and R. C. Bishop (1994), Assessing Natural Resource Damages using Environmental Annuities, Ecological Economis, ELSEVIER
\textsuperscript{242} Interim losses are losses which result from the fact that the damaged natural resources and/or services are not able to perform their ecological functions or provide services due to time lag from the time that the damage occurs until the primary or complementary measures to take effect (ELD, Annex II (1) (d)). In other words, interim loss is the reduction in the natural resource value to the public or to another natural resource and it may be difficult to be measured. Provisions providing remediation for interim losses are highly significant, especially in cases of severe environmental damages, when the injured sites will not recover fully for a long period of time.
\textsuperscript{243} Source: T. Penn(2001), p. 4.
Economic damages to the public for interim loss may include in addition to the costs of restoration, lost use values and lost non-use values or else passive values. The measure of damages under CERCLA and OPA includes the trustees’ reasonable assessment costs. Allowing the trustees to recover such costs and use the gain to perform other damage assessments, is extremely valuable to the development of an effective natural resource damages program. Under CERCLA, the compensable value is estimated with monetary assessment methods, without specific directions for the selection of the most appropriate valuation method though. In case that there is no impairment of use values, then contingent valuation method comes into force in order to estimate the non-use values.

The use of contingent valuation method under CERCLA does not seem to lead to a factual reduction of the cost of compensatory restoration measures. Furthermore, the dispute occurred due to their application might lead to inefficient outcomes. On the contrary, OPA introduces a cooperative style for the determination of compensatory restoration measures, which is an important fact especially in case of dispute. It is notable that under CERCLA, valuation techniques are used for the cost estimation, which it is not based on actual restoration costs. CERCLA does not provide for specific guidelines for the application of these techniques, it refers only to the implementation of cost-benefit analysis. On the other hand, OPA provides only optimal incentive effects for prevention if monetary valuation is used ex ante for a natural resource. In this way though, OPA does not lead to a uniform valuation approach which boosts the prevention effects.

As already stated, economic approach issues are distinguishable in Articles 2 and 16 under the ELD. Annex II defines the preconditions for the implementation of monetary assessment methods, which come into force in order to estimate the value of impaired resources, which is necessary for the determination of compensatory remediation measures. According to Annex II (1.2.3) “if it is not possible to use the first choice resource-to-resource or service-to-service equivalence approaches, then alternative valua-

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244 See subchapter below  
246 CERCLA §11.83.  
tion techniques shall be used. The competent authority may prescribe the method, for example monetary valuation, to determine the extent of the necessary complementary and compensatory remedial measures. If valuation of the lost resources and/or services is practicable, but valuation of the replacement natural resources and/or services cannot be performed within a reasonable time-frame or at a reasonable cost, then the competent authority may choose remedial measures whose cost is equivalent to the estimated monetary value of the lost natural resources and/or services”. Likewise OPA, the ELD foresees that, in case of an irreversibly damaged natural resource there is not direct restitution for the loss occurred, but restitution of equivalent resources is required. A monetary valuation of damaged resources is possible, given that the assessment of losses and functions is feasible. However, the assessment of the surrogate of the resource does not seem to follow the rule of proportionality, which is a necessary precondition, as defined in the ELD.248 A significant observation worth to be mentioned is that Annex II 1.3.2 states that “compensatory or complementary actions should provide a similar level of natural resources and/or services as those foregone”. From an economic point of view, this provision implies that the marginal benefit of restoration, the value of which is estimated in monetary terms, should be equal to the negative limit use which occurred due to the damage.

Another significant observation worth to be highlighted is that the measure of damage is no longer the monetary value of the natural resources lost but the cost of compensatory restoration actions providing full compensation of interim losses in order to reduce transaction costs and to deflect some of the controversy about economic assessment methods that are explicitly authorized for determining the monetary value which usually lead to law disputes.

3.2 Introducing the economic value of environmental damage

Environmental resources are unpriced and they are not traded in markets, they do have value though. Economic theory designates the value of the environment in two senses: In the term of its direct impacts on utility to individuals and on production.249 In other words, the valuation of the environment can be realized through the “commodification”

248 See Annex II (1.3.3), ELD.
249 N. Hanley(2002), The economic value of environmental damage, in Environmental Damage in International and Comparative Law: Problems of Definition and Valuation, ed. M. Bowman and A. Boyle, Oxford University Press p. 27.
of the environmental goods and services. These goods and services are treated as arguments in utility and production functions respectively.

Environmental changes, namely changes in the quality and/or quantity of natural resources have an impact on production. The reason why, is that many production processes use as inputs environmental goods. For instance, the annual production of a farmer’s crops is influenced by environmental factors such as changes in rainfall and temperature. The economic value of such changes can be estimated as the impacts on the future stream of profits of the environmental damage, namely the net value of output. However, the present thesis focuses on the influence of the environment in the utility for the individuals in relation to their consuming behavior.

Utility is the satisfaction an individual receives from consuming a good or service. The value of these goods is then measured by the utility they generate. However, individuals can get satisfaction by the environment as well, either directly or indirectly. In other words, a person can increase his utility by interacting with the environment. In case that the quality and/or the quantity of environmental resources change, the utility deriving from them will change too. For instance, if an oil spill pollutes the sea, the swimmers and the visitors of a nearby beach will be dissatisfied, thus utility deriving from the beach will be decreased. On the other hand, individuals can also gain satisfaction from the environment without necessarily getting in touch with it. For instance, some individuals get utility just by knowing that the environment is preserved, without being directly associated with it.

Environmental values which depend on actual use of the environment are known as “use values”, whereas values that are not based on such an actual relationship are known as “non-use values”. In the first category accrue consumptive activities, such as hunting, but also non consumptive, such as birds watching. Another interpretation is that if an individual uses one of his senses to experience a natural resource, he has actually used it. On the other hand, “non use value” demonstrates the worth of the natural resource beyond its “use value”. Tietenberg decomposes “non use value” in two categories. The first one is the “bequest value”, which shows the willingness to pay in order to

250 See Roger Perman, Yue Ma, James McGilvray and Michael Common (2003), Natural Resource and Environmental Economics, Addison-Wesley, p. 400.
251 N. Hanley, The economic value of environmental damage, p. 29.
252 Literature focuses on the pure nonuse value, therefore when nonuse value is mentioned in the dissertation, it refers to “existence value”. See T.Tietenberg and L. Lewis (2012), p. 79-80.
ensure that a resource is available for future generations. The second one is the “existence value”, which is considered the pure nonuse value and is measured by the willingness to pay for the preservation of the environment, though without any interest for future use by the payer. Given that nonuse values derive from motivations other than personal use, they are less tangible than use values. Both use and nonuse values compose the total economic value (TEV).

As long as the satisfaction or the well-being an individual gets from a natural resource is affected positively or negatively, for instance by an environmental externality, there is a value that follows this increase or decrease of well-being. This value is necessary to be estimated, though putting monetary value on this kind of resources is characterized by high difficulty. As it is already mentioned, a change in the quality and in some cases in the quantity of natural resources will change the value of these resources, which implies economic costs. More specifically, deterioration in the environmental quality, due to an oil spill for instance, will change the economic value of the natural resource and will create economic costs. However, since many of these costs do not have a market value, special non-market valuation techniques are necessary in order to estimate them.

As it is indicated in Chapter 1, the value of a good or service, which is reflected in its price, shows how much the consumers are willing to pay in order to acquire it or not to lose it and it equals to the marginal utility they get from consuming this good or service. For instance, the economic value of an increase in air quality in a city is given by the maximum that residents are willing to pay in order to live in a clearer atmosphere. Alternatively, the residents are willing to accept a minimum compensation in order to bear a polluted atmosphere, for instance from a nearby power plant. Willingness to pay (WTP) and Willingness to accept (WTA) are the two main proxies used to measure environmental value.

Values that are not traded in a market system might be difficult and costly to be estimated. The reason why is the unfamiliarity with price estimation of such kind of goods

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and services, as well as that many of these values manifest themselves only as emotions or intellectual conclusions. However, in the YS American tort law system there is great experience in assessing the value of nonmarket damages suffered by plaintiffs. From an economic point of view, a complete damage award promotes efficiency through deterring undesirable behavior by involved parties in environmental damages.  

3.2.1 Why valuing the environment?

The belief that the environment has a value that goes beyond its utilitarian value is quite consistent with modern economic valuation techniques. Through these techniques it is possible for both the use and nonuse values to be estimated. This estimation is based on human preferences; This fact that this kind of valuation is based on human preferences has triggered great controversy. On the one hand, some ecologists debate with convincing arguments that allowing humans to determine the value of other species raises doubts regarding moral issues. On the other hand, proponents of valuation techniques stress that if humans do not put a value on the environment, then a default value of zero will be assigned in the estimations designed for public policies, which will lead to environmental degradation.  

On the other hand, the argument in favor of environmental protection is based on the fact that the environment has “intrinsic value”, which is independent of the human interests. This value comes in contradiction to the “instrumental value”, the aforementioned value of the environment which derives from its usefulness to humans. The definition of the “intrinsic value” of the environment remains elusive, as it incorporates elements which are defined by their importance in relation to the ecosystem.  

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259 The literature points out three different aspects in the valuation of an element: the instrumental, the inherent and the intrinsic value. The instrumental value of an entity is defined by the practical purpose of this entity or the use it may be put, as in the case of fish being consumed for food. The inherent value is defined by the worth that an entity possesses on account of it being prized for itself rather than its utility. Regarding environmental resources, inherent value may be based upon an aesthetic appraisal, for instance. Lastly, the intrinsic value represents the value that an entity possesses of itself, for itself and which consequently does not depend upon the existence of an external value. It is used often used for environmental assets, displaying the value that resides in the asset in question and is independent of human preferences; this value is difficult to be defined though. One of the main difficulties in adopting a legal approach that respects the intrinsic value of nature is the widely accepted economic valuation methods. For more details see De la Fayette L. (2002), Biodiversity, Intrinsic value and the Definition and Valuation of Environmental Harm, in Environmental Damage in In-ternational and Comparative Law: Problems of Definition and Valuation, ed. M. Bowman and
that the intrinsic value incorporates human preferences, it cannot be encompassed in the total economic value. However, notions of intrinsic value might influence WTP of individuals.\textsuperscript{260} Therefore, economic valuation is considered a way to demonstrate the significant value of the environment to society.

3.3 Cost-benefit analysis (CBA)

CBA is widely used for decision making and policy design. It is based on the idea of environmental externalities and through various techniques it can be applied on environmental issues. CBA is based on the notion of human preferences, which are intimately connected to utility or well being to humans. More specifically, it provides rules for aggregating preferences so that it enables a “social preference” for or against an in our context environmentally relevant issue. Individual preferences are revealed through choices in the market place, through decisions to spend or not money.

The CBA approach, instrumentalised in the context of the present study, weigh up the profits of the polluter against the damage done to the environment.\textsuperscript{261} In order for a polluter’s activity to be efficient, profits should exceed damage.\textsuperscript{262} Profits or benefits are defined as increases in utility or well being and damages or costs as reductions in utility. CBA valuation process is the same for both benefits and costs, which are measured in monetary terms. The money values of both reflect human preferences as expressed

\[ \sum_{i,t} (B_{i,t} - C_{i,t})(1+s)^{-t} > 0 \]

where \((1+s)^{-t}\) is the so-called discount factor. Through discounting, one unit of future costs and benefits are weighted less than the same unit of present costs and benefits. Discounting has been developed by economists due to the notion that 1€ today worth more than 1€ tomorrow, even in the absence of inflation.

This formula is also known as net present value (NPV), as it estimates the benefits net of costs and in present time. The basic decision rule for a project or policy to be accepted as an efficient one is that NPV should have a positive value, namely the present value of benefits must exceed the present value of costs. Otherwise, the underlying project or policy should be rejected. Note that in order for the calculation of NPV to be achieved, the discount factor is held constant and inflation is considered to be zero. Further analysis of theoretical foundations for CBA is considered to be outside the scope of this thesis. However, for a more detailed analysis see D. Pearce, G. Akinstion and S. Mourato (2006), p. 41-49; L. Heinzerling and F. Ackerman (2002), \textit{Pricing the Priceless: Cost-Benefit Analysis of Environmental Protection}, Georgetown University, p. 6.
through willingness to pay.\textsuperscript{263} Hence, CBA valuation is inextricably linked to WTP and WTA.

These notions are grounded in the theory of welfare economics. According to economic theory, these values should be almost equal, though in practice they diverge with WTA to exceed often WTP. Diagrammatically WTP and WTA can be demonstrated as consumer and producer surplus respectively.\textsuperscript{264} For goods and services that are bought and sold in the marketplace, the estimation of these values is based on market prices. However, the estimation of these values for nonmarket goods and services demand the examination of the behavior of the individuals. The fact that CBA is based on individuals’ intentions and not on their actual behavior constitutes the main concern of opponents of CBA. More specifically, WTP and WTA might differ in practice, often in a large amount. An explanation to this is that WTP is restricted by income, whereas WTA is not. Furthermore, individuals tend to value losses more highly than equivalent gains. This implies that a choice should be made between WTP and WTA for each incident occurred. This choice is influenced by property rights which accrue to the involved parties. For instance, in case of a prospective environmental loss, if individuals have the


\textsuperscript{264} Demand depends on WTP and supply on WTA, so that the interaction of both in producing a market price provides a measure of value for goods and services. Indicatively, WTP is the area under the demand curve up to the quantity consumed, as shown in the diagram. In other words, WTP represents the net loss to the society when resources are impacted by pollution. However, opponents of this kind of measure of consumer surplus (Marshallian measure) argue that this is not a true measure of the benefit of a price change, as the variable that is held constant is income. On the contrary, Hicks has produced several measures of welfare change in the context of a price change, in which the constant variable is welfare (utility). For more details see T. Tietenberg and L.Lewis (2012), p. 112; E.P. English, C.H. Peterson and C.M. Voss (2009), Ecology and Economics of Compensatory Restoration, p. 120; N. Hanley, The Economic Value of Environmental Damage, p. 29-30; D. Pearce, G. Aktinson and S. Mourato (2006), p. 157-160.
right to enjoy the pre-loss level of environmental quality, then WTA should be measured. Alternatively, if they have no such right, WTP measures should be sought.\textsuperscript{265}

Cost-benefit analysis has triggered intense controversy among scholars. There are some impediments which have to be overcome in order for CBA to gain further acceptance. The problem areas are identified in respect to the robustness of value estimates, the transferability of value estimates, property rights and some ethical issues.

3.4 Valuation techniques

The valuation of environmental, nonmarket goods can be achieved with several techniques available, which are divided into two main categories: stated preferences methods, which are also known as direct methods and revealed or indirect preferences methods, as shown in the following figure. The former are survey based methods, in which individuals are asked directly about their maximum WTP or minimum WTA by using principally questionnaires. More specifically, respondents are required to put a price to different levels of the nonmarket goods or to rank different scenarios. Finally, valuations are estimated on individuals’ responses. The most common techniques which fall into this category are Contingent Valuation and Choice Experiments. In Revealed Preferences methods researchers seek to uncover economic values for the environment by deliberating actual behavior in related markets. The most common techniques of this category are Hedonic Price and Travel Cost methods. Revealed preferences methods can estimate only use values, as they are based on actual behaviors, while stated preferences methods could estimate nonuse values, as they are based on individuals’ intentions, while.\textsuperscript{266}


\textsuperscript{266} According to most bibliography, stated preferences methods are used in order for nonuse values to be estimated, though N. Hanley states that these methods are capable of estimating both use and nonuse values, as they are based on individuals’ intentions and not on their actual behavior. See N. Hanley, The economic value of environmental damage, p. 31-33.
3.4.1 Stated Preferences Methods

This category of valuation methods is also known as “Direct” methods, the most well-known of which is Contingent Valuation (CV) and Choice Models (CM). However, bibliography has principally addressed the former technique, stressing in this way the significant role it holds in consolidating the assessment of use and non-use values in the US and EU.

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268 In a choice experiment respondents are asked to choose their most preferred from a choice set of at least two options, one of which is the status quo. Just to mention a prominent strength of CV method, its ability to value environmental changes which are multidimensional. That is, entailing changes in a number of attributes of interest. Similarly to CV, CM is a survey-based technique, though it differentiates in some points of application from CV. Therefore, emerging interest has arisen regarding the potentiality of CM method in response to the problems of CV. However, CM is only recently applied and only a few studies are available in order to set the ideal background for its further analysis. Thus, given the existing surveys it would be constrained to proceed to conclusions regarding whether this new technique has the potential to supplement or even solve the impediments that the broadly applied CV encounters. As such, only a brief analysis of CV will follow. For more information regarding CM see Lancaster, K. (1966), “A New Approach to Consumer Theory”, Journal of Political Economy, Vol. 84, pp. 132-157; R. Perman, Y. Ma, J. McGilvray and M. Common (2003), p. 436; D. Pearce, G. Atkinson and S. Mourato (2006), p. 125-137.

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3.4.2 Contingent Valuation (CV)

One of the most widely used, but simultaneously the most controversial method for assessing both use and non-use values, is the Contingent Valuation method. This term is actually used, as individuals are asked to declare their WTP or WTA contingent on a hypothetical scenario regarding an environmental service. This scenario includes a hypothetical market for the nonmarket good, in which individuals can pay for the good in question.\(^{269}\) However, the fact that this method is not based on actual behavior, but on the individuals’ responses to hypothetical questions, has triggered constant debates in the economic literature, regarding the validity and reliability of the surveys’ results.\(^{270}\)

The application of the CV method is considered to be a complicated and expensive process. CV is a survey-based method, which is mainly conducted through personal interviews, direct or through telephone and e-mail surveys. In order to collect useful data and provide reliable results, the CV survey should be properly designed, pre-tested and implemented. As the results of the CV method are sensitive to individuals’ perception of the hypothetical concept, it is essential that the survey questions and the scenario described be accurately defined.\(^{271}\) As stated previously, individuals are about to respond how much they would be willing to pay either to avoid a negative occurrence or to bring about a positive occurrence. The means of the payment or also known as payment vehicles might include a direct tax, an income tax or an access fee. A question which is frequently encountered during the survey is whether the respondents should be examined on their willingness to pay or to accept.\(^{272}\) Another issue that should be clearly de-

\(^{269}\) In order to elicit a valuation or a bid for the non-market good, two necessary preconditions are that the bid should be close to value if market for good existed and the hypothetical market as close as possible to real market. Typically, two scenarios are compared. The first one, is the baseline or old scenario, “o”, which demonstrates the status quo or the real world level of nonmarket good and the second one is the hypothetical or new scenario, “n”, which represents the state of the world after policy or the new level of nonmarket good. Given the assumption that o is preferable than n, respondents prefer to stay to o situation and they are required to value the shift from o to n. The valuation may be a willingness to pay to stay at o or a willingness to accept compensation for moving to n situation. Total valuation is obtained by aggregating individual valuations. See R. Perman, Y. Ma, J. McGilvray and M. Common (2003), p. 420; Contingent val.method pdf, p. 8-9; Ulibari(1997) p. 25


\(^{271}\) Ecosystem Valuation (2013), http://www.ecosystemvaluation.org/contingent_valuation.htm

\(^{272}\) According to environmental economics theory, asking about WTP for an environmental improvement implies that the individual is entitled to the existing level, as does asking about WTA compensation for deterioration. According to Kopp, all determinations of economic value are constructions of choices. The circumstances of choice specify the assignment of rights of control over the object of choice and determine the valuation perspective, namely WTP or WTA. (p. 11). Ulibari(1997) p. 26.; R. Perman, Y. Ma, J. McGilvray and M. Common (2003).p. 421
scribed in the survey is the change of interest, in the form of increases or decreases of the quality and/or quantity of a specific environmental service.

However, a number of factors might systematically bias respondents’ answers. Hypothetical, information and strategic biases are the most common technical challenges that researchers come across. Another factor that might influence individuals’ final WTP response is the payment vehicle. Additionally, the fact that WTA usually exceeds WTP, as well as the fact that the CV method relies on individuals’ intentions and not actual behavior consist maybe the greatest weaknesses of this method. Nevertheless, the constantly increasing studies that are devoted to CV method constitute a helpful background for a more accurate and reliable implementation of the technique.

3.4.3 CV in the US

Although controversial, CV method is widely used in the US during the last decades. This has been tied to the increasing use of CBA by Federal agencies, as the Executive Order issued by Reagan Administration required CBA on major regulations. The implementation of CV method was especially boosted by a special Panel, which was appointed by the National Oceanic and Atmospheric Administration (NOAA) in 1993 and was co-chaired by two well-known economists, K. Arrow and R. Solow. The Panel presented several guidelines on the design of CV studies for valuing non-use damages to natural resources. For instance, as far as the application procedure of the method is concerned, Arrow stresses that in-person or telephone interviews might lead to more reliable results than email surveys. In general, Arrow raised the standards to which CV studies undertaken for policy and damage assessments must meet. Furthermore, the

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274 J. B. Loomis, Contingent Valuation Methodology and the US Institutional Framework, in Valuing Environmental Preferences p. 622
275 However, There is a notable differentiation in the application of CV under the Panel. Precisely, for the Panel a CV exercise is actually a way for the respondents to express their willingness to pay or not to pay taxation regarding a specific purpose. In other words, CV is not used in order to value non-market environmental assets according to consumers’ preferences, but in order to gather information on the voters’ WTP taxes for environmental programs and accordingly, adjust environmental policies. This is considered to be an important shift in the perspective of CV application. See R. Perman, Y. Ma, J. McGilvray and M. Common (2003), p. 434.
acceptance of CV for measuring non-use values, together with the guidelines available are expected to boost even more the implementation of CV method in the future.\textsuperscript{277}

To date, CV remains the prevailing technique available for the estimation of total economic values. However, it is the most controversial method, as it raises concerns for its validity. Therefore, NOAA's panel recommended guidance to ensure reliability when using CV surveys to estimate passive use values. Kopp points out four categories of issues which appear to be shaping the current and future debate over the inclusion of passive use values in the context of damage assessment and in the execution of cost-benefit analyses of the US federal regulatory programs.\textsuperscript{278} These include economic and legal issues, as well as business and political concerns. He also stresses that the fact that NOAA provides outstanding studies regarding the implementation of the CV and detailed guidelines, is a major effort, capable to lead to relatively reliable and valid outcomes if followed closely.\textsuperscript{279} Nevertheless, this procedure might be expensive and time consuming. Businesses seem to react to the increased cost of CBA implementation, as it will decrease their competitiveness in the world market. The fact that CV will be used extensively by trustees to estimate passive use values for all types of cases regardless of the degree of potential injury will generate large estimates of damage. This being the case, insurance companies might view such future claims as "unbounded" and thus be reluctant to insure certain activities that may give rise to natural resource damage claims.\textsuperscript{280}

3.4.4 CV in the ELD: Challenging its receptive openness Directive 2004/35/EC in favor of possible efficiency gains

To date, CV method has been developed and applied in a larger extent in the US rather than the EU. This is partially justifiable, because of the absence of guidance regarding the use of valuation techniques within the EU legislation. However, several studies conducted in EU Member States, have demonstrated that there is awareness over the CV method and that it is publically acceptable. Noticeable surveys regarding the potential

\textsuperscript{279} The first demonstration of construct validity for a CV study that meets most of the NOAA Panel guidelines is found in Carson et al. 1992.
and the application of CV have been conducted in UK and Scandinavia and since 1990s France and Denmark have entered into the research field.\(^{281}\)

A more systematic and compensatory implementation of CV has been observed in Germany and the Netherlands. These countries have approached the US pattern in relation to the use of CV in the decision-making process. Both countries have given priority to the implementation of CV to air-pollution cases, with the Netherlands being the first EU Member State, which used the CV method in practice. In UK CBA dominates the government appraisals of projects and policies, although guidelines boosting the use of CBA are also absent from most national legislations.\(^{282}\)

The experience gained in the EU during the last decades shows that CV is a promising technique, which has a lot to contribute to public decision-making. It is necessary though that legal provisions be adopted, in order to promote a symbiotic relationship between decision makers and economists.\(^{283}\)

\subsection*{3.4.5 Revealed Preferences Methods}

This category of valuation techniques is also known as “Indirect” techniques, the most common of which is the Hedonic Pricing and Travel Cost method. Each approach has a different conceptual basis and applies to different environmental goods, though both concur in that they use market information and actual behavior in order to value non-market impacts.

\subsection*{3.4.6 Hedonic Pricing Method (HPM)}

This technique was firstly proposed and used in the early 1970s and was widely applied in atmospheric pollution cases. Furthermore, it can be used to estimate economic benefits or costs associated with environmental quality and/or environmental amenities, in-

\begin{footnotesize}
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\item\(^{282}\) F. Bonnieux and P. Rainelli (2001), p. 596;
\end{enumerate}
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cluding water quality and noise, proximity to landfill or recreational sites and aesthetic views. However, it is widely used in order to value environmental amenities that affect the price of residential properties. For instance, clean air is a non-market environmental good, it does influence housing prices though. According to hedonic pricing method, there is a positive relationship between the prices that individuals are willing to pay for housing and the quality of ambient air standards. Consequently, house pricing is considered to reveal information about the air quality as well. 284

More specifically, any particular house can be described by a combination of characteristics, which usually include the housing structures (age, fireplaces, living area), the neighborhood variables (housing density, school quality, public safety expenditure), the accessibility variables (distance to beach) and air pollution variables (log of ambient concentration of suspended particulates). The combination of these characteristics for a particular house determines its price.

The role of HDM is to indicate the individuals’ marginal WTP for each housing characteristic. The procedure for this estimation requires the collection of large amounts of data, including rent and/or house prices, as well as characteristics of properties in an area. This data is then used as input in statistical techniques, in order to estimate a hedonic price function, which constitutes a locus of equilibrium prices for the sample of houses. These prices result from the interaction of buyers and sellers in the property market. The marginal implicit price is compared to the buyer’s valuation of the characteristics. The buyer will choose those levels of characteristics, so that their valuation equals the implicit price. 285

The main strength of HDM is that it is based on individuals’ actual choices and not on their intentions. Furthermore, given that data collection in property markets values can be realized relatively easily and with reliable values, results are considered to be relatively valid. However, HDM requires a large amount of data, which is not always easily accessible, thus the technique might prove to be expensive. Another limitation of HDM is the fact that it is based on the individuals’ WTP for perceived environmental proper-

284 According to the OECD report in 2006, there are two types of market that are of particular interest for non-market valuation under the Hedonic Pricing method: property and labor markets. However, HPM method is most often applied in the first ones. Thus only a brief analysis of the application of HPM in property markets will follow. See D. Pearce, G. Atkinson and S. Mourato (2006), p. 93; R. Perman, Y. Ma, J. McGilvray and M. Common (2003), p. 435; Ecosystem Valuation (2013), http://www.ecosystemvaluation.org/hedonic_pricing.htm
ties and their consequences on humans. However, if respondents are not aware of the inextricable linkage between the environmental attributes and the benefit or harm to them and their property, results will not be reliable, as home prices will not represent their true value. Another weakness of the technique is that it is based on the individuals’ WTP, which is limited by their income. However, property markets might be influenced by other factors too, such as interest rates or taxation, which are not taken under consideration in the technique.286

3.4.7 Travel Cost method (TCM)
This technique was firstly developed by Clawson and Knetsch and its main idea is that the values that individuals place on environmental amenities should emanate from the costs incurred by individuals in order to experience the environmental services.287 TCM is used to assess use values associated with recreational sites. Precisely, the method estimates benefits or costs emanating from changes in environmental quality, elimination of an existing site and addition of a new recreational site. The ‘price’ of access to the recreational site is represented by time and travel cost expenses in order to access the site. Thus, individuals’ willingness to pay to visit the site can be estimated according to the number of trips that they make at different travel costs. This could be compared to the individuals’ willingness to pay for a marketed good based on the quantity demanded at different prices. Total amenity value is inferred by aggregating the individual values.288

The fact that TCM includes time costs of travel is considered to be of great interest in the literature. The time that individuals need in order to access the site incorporates an opportunity cost that should be estimated. This cost represents the highest value that a productive resource such as a natural resource, could return if placed in its best alternative use. However, there are a number of impediments regarding the estimation of time cost. It is widely accepted that the cost of not working or alternatively the wage rate is

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the proper way to value time. However, the fact that a portion of individuals may not belong to the labor force causes problem in time cost estimation.

In addition, for some individuals the time they spend in order to visit the site is considered to be part of the total leisure, thus it has positive and not negative value.\textsuperscript{289} The number of visits to the site is also influenced by several factors, with distance being one of the most important ones. The individuals who live far from the site will access it less often. In addition, people with higher income usually travel more often. Furthermore, the number of alternative sites or substitutes as well as personal interest in the specific site, also influence the number of visits to the site.

According to Ulibarri, the greatest disadvantage of Travel Cost method as well as other indirect techniques is that they cannot be used unless there is some easily observable behavior that can be used to reveal values.\textsuperscript{290} TCM has a limited scope of application, as it requires user participation and it cannot be applied in order to estimate non-use values. Therefore, the benefits of preserving a site with unique qualities might be underestimated. Furthermore, the model assumes that individuals take a trip for a single purpose; this is an idealized scenario though. Travel costs of multipurpose trips remain difficult to be estimated.

Nevertheless, TCM is a relatively uncontroversial method, as it is modeled on standard economic techniques for measuring values and it is based on individuals’ actual behavior. In addition, it is easy to be implemented and interpreted and it is relatively inexpensive.\textsuperscript{291}

3.5 Conclusions

Putting a monetary value on the nonmarket environmental goods and services may beget ethical concerns, although it is deemed imperative in order for environmental damages to be fairly and effectively fronted, without causing severe environmental degradation and as a consequence, harm to human health. Thus, Natural Resource Damage As-


\textsuperscript{291} For advantages and disadvantages of Travel Cost Method see Ecosystem Valuation (2013), http://www.ecosystemvaluation.org/travel_costs.htm
essment regulations are of great importance and are explicitly stressed in both the US and EU environmental legislations.

Both legislative regimes introduce the notion of monetary valuation for the estimation of the cost of environmental damage. Monetary valuation is deemed to be even more significant in cases that the environmental damage occurred is of great severity and/or the injured site is of great scarcity.

Furthermore, compensatory restoration which is estimated by monetary valuation techniques is considered to be appropriate the more geographically distant is the alternative site from the injured one and the more the measures taken are differentiated from the primary remediation measures. Positive impacts of a respective EU regulations will depend on the willingness in the EU member states to apply economic valuation methods.292

CERCLA provides for some general guidelines for the application of valuation techniques in order for compensatory remediation costs to be assessed, whereas the ELD refers to monetary valuation only in a general spectrum.

OPA has contributed a lot to the boost of Contingent Valuation Method with the appointment of NOAA Panel in 1993. CV is the most controversial assessment method which is though widely applied in both the US and the EU. In the debate over the appropriate uses of the CV the main concerns are whether this method supports what it purports to show and whether its application produces consistent results. These validity and reliability issues concerning the underlying technique has also triggered great criticism on whether it should be used in litigation and be admissible in the courts. However, doubts regarding the applicability of CV are expected to be eliminated, as present studies and useful guidelines could constitute a helpful background for its future use. As a consequence, the use of CV method is not expected to counter efficiency problems in the future.

To date, techniques for the monetary valuation of environmental damage have been more extensively developed and applied in the US, rather than in the EU. CV as well as other valuation techniques are in a relatively early stage in the EU, with little bibliog-

raphy to have been occupied with their applicability, setting the thorough examination of them difficult. CV is already implemented in some Member States for the estimation of both use and non-use values. Its wide spectrum of application make CV flexible and easily applicable, however, an appropriate legal background is necessary in order to boost the reliable development and implementation of the method. Taken as example the US case, only with appropriate guidelines and existing studies the CV method could gain the states’ and public’s approval.

Travel cost and Hedonic pricing methods are also promising valuation techniques; however their narrower application fields might constitute a substantial impediment for their further implementation at the moment.
4 Final Conclusions

The first part of this thesis endeavored to analyze in detail the regime of the Liability Directive from an economic point of view. The ELD constitutes a framework directive, which is based on the polluter-pays principle, thus the examination of whether this directive leads to economic efficient outcomes is imperative. Although ELD constitutes an innovation on the level of the European Community, it did not escape intense criticism. The directive establishes only a form of minimum protection for the environment and it does not aim at harmonizing fully the national legislations. It was criticized for having a narrow scope of application, as well as being complex and ambiguous. Therefore, its implementation encountered impediments, one of which was the transposition to national laws. In addition, Member States are granted a large amount of discretion regarding significant points of the Directive which might undermine a uniform implementation into their national legislations.

Furthermore, some issues included in the Directive that have triggered great controversy among scholars, are scrutinized from an economic perspective. The most important of these issues are insolvency of the polluter, causation link between the operator and the damage caused, retroactive application of the Directive and defenses of the polluters.

The US legislation seems to outmatch in the whole the European Directive, as it promotes a more circumstantial and accurate legislative frame. Many provisions of the ELD have been based on the respective provisions of the US regimes, namely CERCLA and/or OPA, especially regarding issues for which the US disposes long time experience. The ELD provisions for natural resource damage assessment rely basically on those of OPA.

Both CERCLA and OPA focus on the restoration of the injured natural resource to its baseline condition. CERCLA focuses its interest on the monetary valuation of the damaged resources with equivalent methods, as suggested in its provisions. OPA supports the non-market valuation techniques, without indicating them in detail though. On the contrary, the normative program of the ELD foresees only a general direction for monetary valuation, permitting the implementation of economic valuation techniques though; in my point of view, the legislator seems that did not want to be bound to a specific
damage assessment method. The significance of the estimation of the cost of compensatory restoration is extremely highlighted under OPA. Unlike CERCLA, OPA enables the minimization of the risk of disputes. The development of any positive impacts of economic assessment concepts of CERCLA and OPA on the specific economic motivated provisions in Annex of the Directive will depend on the willingness in the EU member states to apply economic valuation methods.
To date, the valuation techniques which are described in the present thesis and are used for the environmental damage assessment, have been more extensively developed and applied in the US rather than in Europe. A notable observation is that, in part, this reflects the difference in public concern for the consequences of changes in the quality and quantity of available natural resources and the effects of pollution on human health.
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