
23 Environmental policies choice as an issue of informational efficiency

Donatella Porrini

Choosing between different environmental policy instruments

The problem of the choice of environmental policy instruments has been an issue since Pigou (1932) analysed the need for state intervention when private costs diverge from social costs, and suggested that the solution would be to internalize the externalities through taxation. Coase (1960) criticized the proposed state intervention, and affirmed that there is no reason to suppose that governmental regulation is called for simply because the problem is not very well handled by the market or the firm. The key feature is the presence of transaction costs that make one policy better than another.

The ensuing debate has been conducted along these two opposite views: on the one hand, the supporters of the idea that the choice of policy instruments to be applied following a market failure is a public matter and the state, as policy designer, should select the optimal instrument and take responsibility for its imposition in the public interest; versus, on the other, the supporters of market-based instruments, trying to fight a battle against a sort of ‘anti-market’ mentality based on a reluctance to apply market-oriented instruments (Lewis, 1996).

If we want to continue along these lines the problem would be to compare the efficiency of instruments that can be considered ‘public oriented’ and those that can be considered ‘market oriented’, where the first are characterized by a public agency with a public definition of conduct rule and a public enforcement system and the second are instruments based on market mechanisms stimulating the conduct of the firm indirectly and characterized by a private administration and enforcement system.¹

Given this premise, the definition of a superior and not ideological line to be followed in the choice between different environmental policy instruments would appear to be a very difficult task.

But looking at this problem from a law and economics perspective, we can move from the theoretical definition of the efficiency of different instruments to their practical, and so direct, potential to achieve concrete objectives. In particular, three objectives emerge as relevant in judging the practical efficiency of environmental policies: the first is paying accident compensation to the victims; the second is prevention, in the sense of providing incentives for

firms to improve safety standards; and the third is connected with technological change in the sense of encouraging firms to adopt lower-risk technologies.

Given these three objectives, this chapter will analyse the efficiency of environmental policies, focusing on the imperfections that can emerge in their practical applications. In particular we shall concentrate on informational problems that can characterize the activities of the agencies and private firms in relation to the efficient implementation of the different environmental policy instruments.

In order to specify and precisely define the various instruments, Figure 23.1 presents a scheme of the different environmental policy instruments that will be examined. The first choice is between liability and regulation, where the latter includes a subdivision between, on one hand, a 'command-and-control' form of regulation based on the definition of standards and, on the other, market-based instruments as an indirect form of incentive for private firms. Another subdivision can be considered at this point: typically, command-and-control regulation can be either technology or performance-based standards. On the other side, liability is an instrument based on the judiciary system, and can be assigned on the basis of a negligence or a strict liability

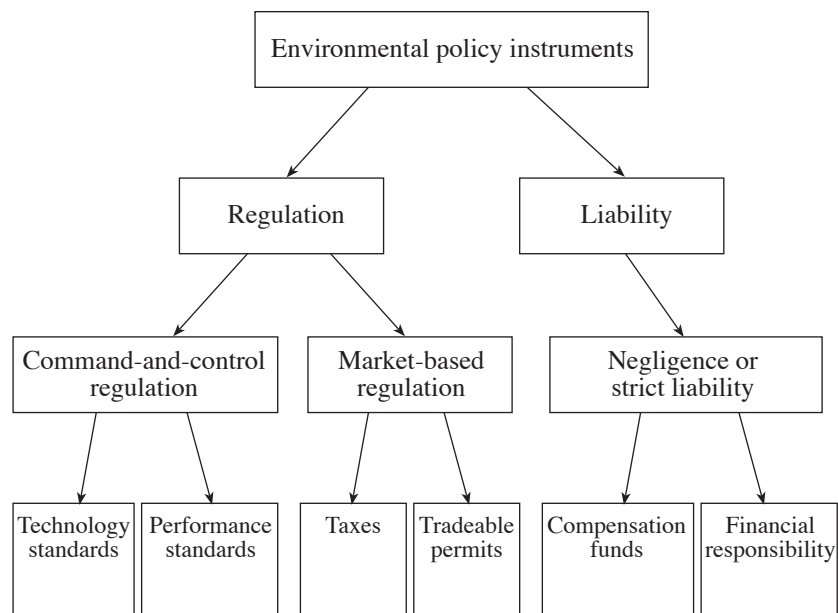


Figure 23.1 Scheme of different environmental policy instruments

regime. Finally the limit of 'judgment proofness', which can arise from the application of a liability system when the resources of the responsible party fall short of the damage amount, can be solved in two ways: compensation fund and a financial responsibility system.

Before defining regulation, liability and the other instruments, it should be noted that in practice it is difficult to refer to a specific policy instrument, given that the environmental policy choice usually involves a mix of them.

Regulation versus liability

Regulation and tort law are alternative methods (though often used in combination) for preventing accidents. The former requires a potential injurer to take measures to prevent the accident from occurring. The latter seeks to deter the accident by making the potential injurer liable for the costs of accident should it occur. (Landes and Posner, 1984, p. 417)

However, before dealing with the problem of the comparison between the two instruments we shall first define their main features.

A regulation system is typically characterized by a centralized structure in the sense that it is a system based on an authority or an agency that uses a number of tools to control environmental damages. By 'regulation' we mean 'a directive to *individual* decision-makers requiring them to set one or more output or input quantities at some specified levels or prohibiting them from exceeding (or falling short of) some specified levels' (Baumol and Oates, 1975, p. 126). Usually the regulation system takes the form of the setting of standards: in this case under a mandatory technology or abatement standard, the regulator can order the firms to reduce their emissions by a certain percentage, to emit no more than a specified amount of a pollutant, and/or to install a particular abatement technology. Alternatively, there are incentive market-based instruments, such as marketable permits and taxes (Backhaus, 1999).

First, we can affirm that in a world with perfect or at least complete information, following a law and economics approach, the policy instrument consisting in a regulatory system is efficient in solving the problem of internalizing the potential effects of environmental accidents. In fact, using this instrument, *ex ante* the firm has an incentive to take adequate precautions. But 'problems of measurement and the breakdown of second-order conditions (among other things) constitute formidable obstacles to the determination of truly first-best environmental policy' (Cropper and Oates, 1992, p. 685).

In fact, in an incomplete information context many problems can arise. These will be analysed in the next section in connection with the different forms of regulation.

A liability system for environmental damages can be considered to be a policy instrument in the sense that such a system provides protection for the

victims against the consequences of an environmental accident and gives incentives to the actors in a potential accident to take the necessary preventive measures (Calabresi, 1970; Shavell, 1987). Consider the typical liability system applied to risks created by hazardous activities: in this case the victim files an action against defendants for all injuries caused by their conduct, claiming a causal link between the defendants' conduct and the plaintiff's injury.

A liability system can be applied using either a negligence or a strict liability regime. The law and economics literature generally concludes that both regimes provide a potential polluter with incentives to take adequate preventive measures. But problems arise if we consider the practical application of the regimes and the presence of informational issues. Regarding the specific case of environmental accidents, it is particularly difficult to determine the standard to assign liability on the basis of negligence: for example, pollution has many sources and many victims and it is a hard task to prescribe efficient pollution standards based on a calculus of the abatement cost and the external harm of every source of pollution.

In fact, in the case of assignment of liability for an environmental accident, a strict liability regime is applied more often. In the United States, the CERCLA (Comprehensive Environmental Response, Compensation and Liability Act 1980, 1985, 1996) type of liability is typically a strict, joint and several liability, on the owners and operators of the firm that is responsible for an environmental accident. The liability system in the European Union, as set out by the Commission, in the *White Paper on Environmental Liability*,² is essentially a strict (no-fault) and non-retroactive liability system for damage caused by inherently dangerous activities.³

The two policy instruments, regulation and liability, may present different informational issues, as in Rose-Ackerman (1991, p. 54),

Statutory regulation, unlike tort law, uses agency officials to decide individual cases instead of judges and juries; resolves some generic issues in rulemakings not linked to individual cases, uses nonjudicialized procedures to evaluate technocratic information, affects behavior *ex ante* without waiting for harm to occur, and minimizes the inconsistent and unequal coverage arising from individual adjudication. In short, the differences involve who decides, at what time, with what information, under what procedures, and with what scope.

In a comparison of regulation and liability, Shavell (1984a) considers as a first determinant the difference in know-how between private parties and the regulatory authority related to the benefits of activities, the cost of reducing risks, and the probability and the severity of accidents. It is evident that the nature of the activities carried out by firms is such that private parties could have a better knowledge of the benefits, the risks involved and the cost of

reducing risks. In such a case a liability system is better because it makes private parties the residual claimants of risk control. However, in some cases the regulator is better informed because of the possibility of centralizing information and decisions, in particular when a knowledge of risks requires special replicable and reusable expertise. In such a case, direct regulation is likely to be the better system.

A second determinant is the limited capacity of private parties to pay the full costs of an accident, either because of limited liability or because of insufficient assets. Shavell claims that a traditional liability regime does not provide private parties with proper incentives for taking precautions. A regulatory system can impose decisions on firms either directly or indirectly. So, the greater the probability or the severity of an accident, and the smaller the assets of the firm relative to the potential damages, then the greater the appeal of regulation. But, as we shall see, public funds and financial responsibility can be applied.

The third determinant is the likelihood that the responsible parties would face a legal suit for harm caused. This is a particular problem in environmental risks: in many cases the victims are widely dispersed; they may not be motivated to initiate a legal action; harm may be evident only after a long delay; and specifically responsible polluters may be difficult to identify. Compared with a regulatory system, the liability system is more uncertain and provides less incentive for risk control.

The fourth determinant is the amount of administrative expense incurred by the private parties and the public. The cost of a liability system includes the cost of compliance, the legal expenses and the public expenses for maintaining legal institutions. The cost of the regulatory system includes the public expenses for maintaining the regulatory agencies and the private costs of compliance. In this case the advantage of the liability system is that legal costs are incurred only if a suit is brought and, if the system works well, in the sense that there are incentives for choosing the efficient level of care, the suits are few and therefore the costs are low. On the other hand, under regulation, the administrative costs are incurred whether or not the harm occurs because the process of regulation is costly by itself and the regulator needs to collect information about the parties, their activities and the risks.

Considering the four determinants, Shavell concludes that administrative costs and differences in knowledge favour liability, while inability to pay and avoiding lawsuits favour regulation. In general, a liability system is more efficient when private parties possess better information and when there is a low probability that an accident will occur. Regulation is usually better when harm is great, is spread among many victims or takes a long time to become apparent, when accidents are not very rare events, and when standards or requirements are easy to establish and control.

Shavell (1984b) deals with the characterization of the relationship between the regulation systems, as complements or substitutes in providing incentives to reduce the level of risk, showing that no single regulation system leads the parties to exercise the socially desirable level of care. This is due to different factors: on the one hand, the agency suffers from a lack of information and, on the other, a liability system presents the possibility that the parties would not pay fully for harm and might not even be sued. Shavell first considers the case where only the *ex post* regulation system or the *ex ante* one can be used and then the case where both systems can be used jointly so that the parties must satisfy *ex ante* standards and are also subject to *ex post* liability. The conclusion is that it is generally socially advantageous to use both *ex ante* and *ex post* regulation systems.

In another contribution, Kolstad et al. (1990) stress that the two policies may be complementary. They claim that even if the phenomenon of complementary use of *ex ante* and *ex post* systems is widespread, the economic literature has generally studied the two separately, characterizing each of them by different inefficiencies. In addition to Shavell's (1984a) four determinants, Kolstad et al. consider the imperfection in the definition of legal standards which may lead firms to choose a level of precaution different from the socially optimal one. They conclude that the liability system, applied jointly with *ex ante* regulation, can correct the above inefficiencies, at least in part.

Other contributions try to include informational issues in the analysis of the comparison between *ex ante* and *ex post* regulation systems. Schmitz (2000) presents a critical evaluation of the above papers suggesting the use of the two systems as complementary instruments to overcome the limited efficiency of liability due to enforcement errors and to injurers avoiding lawsuits. Schmitz proposes the comparison between *ex ante* and *ex post* systems as imperfect instruments through a formal model of how the imperfections affect the outcome: the extension of liability to private financiers is imperfect in so far as the private financier maximizes his/her own profit rather than social welfare; the regulatory agency may be captured by the parties who may cause environmental accidents; an asymmetric information framework is considered where the level of precautionary activities is the private information of the firm. The author shows that if injurers cannot avoid a lawsuit and if the magnitude of liability is set at the optimal level, it can never be socially advantageous to employ both the systems as complementary instruments if all injurers face the same wealth constraints. But joint use can be valuable if wealth varies among injurers and in the latter case, the regulatory standard can be set at a level that is lower than the one corresponding to the social optimum obtained when only *ex ante* regulation is used.⁴

This analysis of the contributions on the comparison between *ex ante* and *ex post* regulation systems has shown some results in terms of the choice of

environmental policies, including informational issues. In the next section we shall analyse in turn different instruments included in the general definition of regulation and liability.

Analysing different forms of regulation

Generally the implementation of any form of environmental regulation requires that the quantity of polluting emissions and the monetary costs of the damage caused by an eventual accident should be determined. This implies setting up a monitoring procedure and then using regulatory tools to set standards or distribute the cost to firms through a tax or through permits based on their polluting emissions.

In each case, informational problems can derive from closely monitoring the firm's conduct, for example, its emission levels, and these problems can lead to an inefficient level of enforcement and to overdeterrence. But these issues need to be analysed in connection with each regulatory instrument.

There are different forms of regulation: public-oriented command-and-control instruments that require the use of a particular technology or the observation of a performance standard, prescribing the maximum amount of pollution that a source can emit; and market-oriented instruments that are essentially pollution taxes or a system of tradable permits. Supporters of command-and-control technology requirements have clashed with devotees of incentive-based approaches advocating taxes and tradable allowances (Wiener, 1999).

Under highly restrictive conditions, it can be shown that both environmental policy instruments share the desirable feature that any gains in environmental quality are obtained at the lowest possible cost (Baumol and Oates, 1975). Hahn and Stavins (1991, p. 6) commented:

Theoretically, the government could achieve such a cost-effective allocation of the pollution control burden among sources if it could ensure by some means that all sources controlled at the same marginal cost. However, such an approach would require the government to have detailed information about the cost functions of individual firms and sources – information that the government clearly lacks and could obtain only at great cost, if at all.

With regard to command-and-control instruments, regulatory measures are generally defined and imposed by agencies that prescribe what measures a firm should take to prevent harm. Therefore, the existence of an agency charged with meeting these objectives is assumed. The essence of the agency activity is to control the actions of many individuals and independent actors (firms, households, other government units), and to induce them to take constraining actions contrary to their narrow self-interests (Bohm and Russell, 1985). These measures can be imposed by general rules or individual li-

cences, taking the form of emissions standards based on a particular quality or quantity of emissions in the environment. Non-compliance with such standards is usually enforced by administrative or criminal sanctions.

Command-and-control instruments set uniform standards for firms: on one hand, such instruments force all firms to shoulder an equal share of the mitigation burden, regardless of the relative costs of this burden to them even if the same firms can adopt preventive measure at much less cost than others; and on the other, the command-and-control instruments directly and effectively limit dangerous emissions.

In its application, this regulation system has proved to be well suited to setting policies regarding the definition and implementation of standards. The centralized search facilities, the continual oversight of problems and a broad array of regulatory tools can make the regulation system capable of systematically assessing environmental risks and of implementing a comprehensive set of policies. But, regulatory agencies may not be very flexible in adapting to changing conditions, and a centralized command structure relying on expert advice may be subject to political pressure as well as to collusion and capture by the regulated firms.

We can distinguish between different kinds of standards: technology or performance. In the former, the firm is not free to choose the measures by which it will achieve a certain environmental quality; this is literally a command-and-control instrument which imposes a certain technology that has to be used by the firm. In the latter, there is some degree of freedom for the firm in the sense that the standard determines the amount and the quality of substances that the firm can emit but then the firm can choose the technology to achieve it.

The performance-based standard does not stipulate any particular equipment to be used to comply with a regulation to achieve a specific ecological goal, thus giving private parties a certain amount of flexibility. This feature can be an advantage in relation to the informational problems connected in general with the use of command-and-control instruments: the agency activities are not costless – checking the behaviour of the actors against applicable regulatory orders, or determining what is owed by way of emission charges implies some expense; the activity of monitoring is another cost for the agencies; there is also the so-called ‘capture’ problem – public agencies can be motivated by financial rewards and promises of promotion or there can be a connection between their own and their firm’s interests given that they are vulnerable to bribery from third parties or from the offenders they are supposed to monitor.

We can now analyse other kinds of regulatory instruments, which, in contrast to command and control, do not directly prescribe what the behaviour of potentially polluting firms should be. A Pigouvian tax, for example, is a way to attribute a price to pollution that will be incorporated by the firm in

the price of its products, but the incentive for the adoption of abatement techniques relies on the market mechanism because if a firm does not apply the optimal techniques, it will produce more pollution, pay more taxes and sell its products at a higher price than its competitors. Market-based instruments as regulatory devices that shape behaviour through price signals rather than explicit instructions on pollution-control levels or methods, are often described as 'harnessing market forces' because they can encourage firms and individuals to undertake actions that serve both their own financial interest and public policy goals (Stavins, 1998).

Using these instruments, rather than traditional command-and-control ones, provides a dynamic incentive for technology innovation. This is accomplished by allowing firms to share the burden of pollution control more efficiently through encouraging them to achieve reductions in pollution more cheaply. So market-based instruments such as taxes and tradable permits should generally be preferred to technology requirements and fixed emissions standards because the incentive-based instruments are typically far more cost-effective and innovation generating than their alternatives (Keohane et al., 1997). In particular, these instruments could provide continuous dynamic incentives for the adoption of superior technology, since it is always in the interest of firms to clean up more if sufficiently inexpensive clean-up technologies can be identified (Jaffe and Stavins, 1995).

Compensation funds versus financial responsibility

A very important problem connected with liability policy instrument is the limit of a firm's financial resources compared with the amount of the damages that could derive from an environmental accident. This problem arises when identified polluters are 'judgment proof' and so not able to pay for the total cost of the environmental damage. Moreover, given that they do not pay the full cost, then they are not motivated to adopt an adequate preventive measure (Summers, 1983; Shavell, 1986).

In the United States this problem arose in cases of smaller firms involved in risky production activities (Ringleb and Wiggins, 1990). From an economic point of view, this is a problem of internalization in the sense that some of the losses of the victims may go unclaimed under conventional strict liability; moreover in some cases, firms facing considerable liability risks may reduce their capital using 'judgment proofness' as an evasion strategy (Van't Veld et al., 1997).

Among internalization instruments, there is one that uses a compensation fund. Usually funds are created in connection with a regulatory system to cover environmental damage, contaminated site costs and victim compensation amounts. The fund can be financed by a taxation system or by a firms' contribution system.

The most important application of this instrument is the one by CERCLA, which enabled the Environmental Protection Agency (EPA) to clean up contaminated waste sites directly by utilizing funds from the Hazardous Substances Response Trust Fund, commonly known as the 'Superfund'. The Superfund was created to provide the federal government with the financial resources necessary for cleaning up contaminated sites and facilities. The fund is financed through a combination of federal appropriations, industry taxes and judgments entered against responsible parties. CERCLA authorized the EPA to target specific contaminated sites across the country and to rank those sites through a national priority list (NPL), which generally determines the order in which the various sites will be cleaned up.

So on the one hand, as in the US experience, compensation funds as environmental policy instruments prove to be an efficient kind of emergency tool when a quick intervention is necessary. On the other hand, in the implementation of these public-oriented instruments many problems can arise from a distributional point of view, because the existence of a public fund generates social costs connected with taxation sources that make income distribution problems relevant (Lewis, 1996). Moreover from a law and economics point of view, the literature shows that this system can result in a lack of motivation by firms to adopt preventive measures (Porrini, 2001).

We can also analyse another kind of instrument as an alternative to solve the judgment-proof problem: financial responsibility. By this, we consider all the tools that require polluters to demonstrate *ex ante* sufficient financial resources to correct and compensate for environmental damage that may arise through the activities of a firm. In its common application, financial responsibility implies that the operation of hazardous plants and other business is authorized only if firms can prove that future liability claims will be financially covered, for example, letters of credit and surety bonds; cash accounts and certificates of deposit; self-insurance and corporate guarantees. Letters of credit and surety bonds are purchased from banks or insurance companies: they are paid to a third-party beneficiary, often the government, under certain circumstances such as the failure of the purchaser to perform certain obligations. Cash accounts and certificates of deposit place cash or some other forms of interest-bearing security into accounts that are made payable or assigned to a regulatory authority. Self-insurance is purchased by companies with relatively deep pockets to satisfy coverage requirements by demonstrating sufficient financial strength. A corporate guarantee allows another firm, such as a parent corporation, to satisfy the coverage requirement and financial guarantors must themselves agree to cover the liabilities of the firm (Boyd, 2002). Since the 1980s, financial responsibility has been widely applied in the United States within the framework of the liability assignment system for environmental damage.⁵

While a market for assurance coverage has developed in the United States to provide a wide variety of financial instruments tailored to individual firms and regulatory needs, in the European Union this kind of instrument has a corresponding importance but relatively little diffusion.⁶ However, this does not exclude the possibility that financial responsibility instruments have already been provided within the individual member states, and in fact some national enforcement has occurred.⁷

These experiences show that financial responsibility may be complementary, sometimes mandatory, to the legislation on liability assignment of environmental damage. It is usually required as an integral part of some kind of *ex ante* regulation, to ensure that the damaged natural resources are made good. In its different applications, it has a common motivation: to ensure the future internalization of the costs caused by the polluter in order to indemnify the victims and discourage different forms of environmental deterioration.

In the presence of informational issues, financial responsibility can also be seen as a solution to asymmetric information problems that can arise in the relationship between firms and the financiers (Porrini, 2002). First, given the contractual relationship between the financial institutions and the firms, there is a strong incentive for the financial institutions, insurance companies or banks, to check that the firm is taking adequate preventive measures (Feess and Hege, 2000). Second, the firm itself is motivated to take precautions because financial responsibility ensures that the expected costs of environmental risks appear on the firm's balance sheet and in its business calculation.

Concluding remarks

In this contribution we have analysed from a law and economics point of view the efficiency of different environmental policy instruments on the basis of the achieved targets and taking informational problems into account.

The literature on the choice between regulation and liability has been reviewed, showing evidence of an increasing interest in informational issues.

Concerning other forms of environmental policies inside the two main categories of regulation and liability, as a general rule whenever the nature of the activities carried out by the firms is such that the private parties have better information about the benefits and costs of reducing risks, then the market-based system is to be preferred. The advantage of making the private parties directly responsible for risk control is clear but an indirect form of involvement, such as through a tax system or through financial responsibility, could also have positive effects.

Moreover, when there are large differentials among firms in the abatement cost of pollution, relying on market-based instruments provides the advantage of economies on the need for public agencies to acquire information. But it is also possible that a public agency is better informed about those risks

because information and decisions can be centralized, particularly when a better awareness of the risk factors requires special expertise to be shared in different cases and situations.

Finally, an important advantage emerges in the analysis of the enforcement of financial responsibility because through this instrument financial institutions, such as banks or insurance companies, can play an important role by using the capital market to create guarantees in favour of companies operating in risky sectors.

Notes

1. For the contrast between private and public enforcement, see Cooter (1984).
2. Commission of the European Communities, *White Paper on Environmental Liability*, COM (2000), 66 final, Brussels, 9 February 2000.
3. In the words of the European Commission: 'Strict liability means that fault of the actor need not be established, only the fact that the act (or the omission) caused the damage. At first sight, fault-based liability may seem more economically efficient than strict liability, since incentives towards abatement costs do not exceed the benefits from reduced emissions. However, recent national and international environmental liability regimes tend to be based on the principle of strict liability, because of the assumption that environmental objectives are better reached that way. One reason for this is that it is very difficult for plaintiffs to establish fault of the defendant in environmental liability cases. Another reason is the view that someone who is carrying out an inherently hazardous activity should bear the risk if damage is caused by it, rather than the victim or society at large. These reasons argue in favour of an EC regime based, as a general rule, on strict liability' (See note 2: para. 4.3, under the title 'The type of liability, the defences to be allowed and the burden of proof').
4. The comparison between liability and regulation can also be modelled using a formal economic approach based on a principal-agent kind of representation. See Boyer and Porcini (2002a, 2002b).
5. Financial responsibility is provided for by CERCLA, by the Safe Drinking Water Act (SDWA), by the Outer Continental Shelf Lands Act (OCSLA), and by the Surface Mining Control and Reclamation Act (SMCRA). Also in the Resource Conservation and Recovery Act (RCRA) and in the Oil Pollution Act (33 U.S.C. §2716 of 1990).
6. In fact, in §4.9 of the White Paper, on 'Financial security', we can find the statement: 'When looking at the insurance market – insurance being one of the possible ways of having financial security, alongside, among others, bank guarantees, internal reserves or sector-wise pooling systems – it appears that coverage of environmental damage risks is still relatively undeveloped, but there is clear progress being made in parts of the financial markets specialising in this area'. And the enforcement of such an instrument seems to be delayed in time, according to the statement that 'Moreover, the EC regime should not impose an obligation to have financial security, in order to allow the necessary flexibility as long as experience with the new regime still has to be gathered. The provision of financial security by the insurance and banking sectors for the risks resulting from the regime should take place on a voluntary basis'.
7. For example, in Italy, the Ministero dell'Ambiente [Ministry of the Environment], in a decree of 8 October 1996, defined the method for granting financial guarantees in favour of the state by companies that carry out waste transportation activities related to reclaiming, restoration of site conditions, waste transportation and disposal, as well as the reimbursement of any further damage caused to the environment. Another example is the Flemish experience, and more particularly the proposals of the Interuniversity Commission for the revision of environmental law in the Flemish region, which made elaborate provisions concerning financial guarantees (Faure and Grimeaud, 2000).

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