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Abstract

Observation of the process of assessing and compensating damages caused by oil spills at sea shows that in most cases, it is difficult to establish a single global estimate of their social cost. Three categories of numbers regarding the costs of pollution are usually encountered following spills: (i) estimates by experts; (ii) compensation claims; and (iii) compensation eventually paid to claimants.

The aim of this paper is to discuss the main factors explaining the observed divergence between these three categories of numbers, and their implications in terms of the allocation of the costs of pollution. Explanatory factors relate to empirical difficulties in applying damage assessment methodologies; to the determinants of the decision by individual agents to claim for compensation ; and to the institutional framework under which compensation operates.

The discussion is based on an analysis of several major oil spills that took place within the IOPC Funds system in Europe, namely the Amoco Cadiz, the Tanio, the Aegean Sea, the Braer, the Sea Empress, and the Erika accidents.

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Support for this research was provided by the French National Program on Coastal Environment, and the Administrative Region of Brittany. The authors wish to thank the Centre for Documentation, Research and Experimentation on Accidental Water Pollution (CEDRE) and the International Oil Pollution Compensation Fund for their support in accessing to documentation on the European case studies, and the people who accepted to share their experience of the compensation process following oil spills, particularly M. Henry, M. Laubier, and the Union Départementale des Associations Familiales du Finistère as regards the Amoco Cadiz case.

Assessing the costs of oil spills in monetary terms may serve several purposes. In practice, it is generally carried out with the primary view to establish the levels of compensation that would leave the victims of a spill whole, at least in financial terms. The cost of oil spills is also a key figure in debates on the development of preventive measures limiting the risks of pollution, and this at three levels. First, information on the costs of oil spills can be confronted with data on the means devoted to the prevention of accidents, in assessing the adequacy and effectiveness of such measures (see e.g. Barde, 1991). Second, information on the costs of oil spills can be confronted with data regarding the amount of effort devoted to cleanup operations in any particular incident, in order to determine efficient response strategies (see e.g. Ward and Duffield, 1992). Third, measuring the monetary costs of damages caused by oil spills and identifying who they are charged to is also a key piece of information in discussions on the role of liability, and more generally of economic incentives, in achieving efficient levels of pollution prevention (see e.g. Shavell, 1987).

Damage valuation thus appears as a key exercise, both in debates on the proper compensation of victims in any particular accident, and in discussions related to the definition of appropriate pollution prevention policies. However, the study of practical examples shows that it is usually difficult to identify a single, global estimate of the social cost of an oil spill, or even single monetary estimates of its partial costs.

In practice, at least three categories of numbers seem to be produced in response to the question: “what was the (monetary) cost of this oil spill?”: (i) estimates of damages calculated applying economic valuation methodologies; (ii) claims for compensation following the spill; and (iii) compensation eventually paid to the victims of the accident. These figures often seem to diverge in practice. Indeed, it appears that a significant part of the estimated costs may not be internalized via the liability system under which the compensation of damages is carried out.

The objectives of the paper are to look at the main factors explaining the differences between the three categories of numbers as they can be observed following oil spills and, based on these results, to assess the extent to which the international system of liability and compensation of oil spill damages can allow the social costs of such pollution events to be internalized. The discussion is based on a retrospective analysis of several major oil spills that took place in European waters in the past twenty five years. In the first section, the information available on these cases is briefly summarized, with particular emphasis on existing estimates of the costs of damages, claims for compensation and compensation paid. The second section is devoted to a preliminary analysis of the main factors explaining the divergence between these figures. The paper concludes with a discussion of the changes that can be expected from recent debates in Europe on the evolution of the liability and compensation system.

The costs of selected major oil spills in Europe.

In the past thirty years, the multiplication of oil spills from tankers in the marine environment has led to the progressive development of an institutional framework for the compensation of damages arising from these pollution events. After the *Torrey Canyon* incident in 1967, a strict liability-based compensation regime was set up in two international conventions : the Convention on Civil Liability (CLC) of 1969, and the Fund Convention of 1971 (1971 Fund). The former established the strict liability of ship-owners in case of an incident, limited to an amount which is linked to the tonnage of the vessel, and associated to compulsory insurance. The latter established a supplementary fund financed by the oil industry, for the compensation

of oil pollution damages that could not be fully compensated under the CLC regime (and, at the time, to also indemnify ship-owners for part of their liability under the CLC. The Fund Convention set up an international organization, The International Oil Pollution Compensation Fund (IOPC Fund), to administer this unique international regime for the compensation of the costs of pollution damage[1].

The following discussion of damage assessment and compensation is based on the analysis of six major oil spills that took place in European waters under this regime, namely the Amoco Cadiz, the Tanio, the Aegean Sea, the Braer, the Sea Empress, and the Erika accidents. The main features of these spills are summarized below.

The **Amoco Cadiz** went aground on 16 March 1978, off the coast of Northern Brittany in France. All its cargo, 220 000 tons of oil, were lost at sea, causing the largest ever oil spill, with over 350 kilometers of coastline contaminated. Under the CLC regime of the time, the liability of the ship-owner was limited to 77 million French Francs (20,4 million 2001 Pounds)[2]. Rather than attempting to establish the ship-owner's fault before French courts in order to overcome the liability limit, the French authorities and the victims took action against the parent company in American courts, leading to a long and costly litigation process.

Two years later, on 7 March 1980, the **Tanio** broke in two off the coast of North Brittany in France, in heavy sea. 13 500 tons of oil were spilt in the marine environment, contaminating 200 kilometers of French coast as well as the British Isles of Jersey and Guernsey. 90% of the claims arising from the spill were related to oil recovery and clean-up costs incurred by the French authorities. This was the first large spill which the IOPC Fund had to deal with. The ship-owner's liability was in this case limited to 11,8 million French Francs (2,5 million 2001 Pounds), and the IOPC Fund's intervention to 244,7 million French Francs (51,4 million 2001 Pounds) under the Conventions. The process of damage assessment and compensation was handled in a much shorter period of time than in the Amoco case, with most of the payments being made within three to five years after the accident. Part of the amounts paid by the Fund was recovered in court from third parties involved in the accident.

The **Aegean Sea** ran aground at the entrance of the port of La Coruna in Spain on the 3rd of December 1992. The ship carried 80 000 tons of oil, of which an unknown amount was spilt, most of the oil being either burnt in the fire that followed the accident, or dispersed at sea. Approximately 100 kilometers of coastline in North-West Spain were contaminated, with particular impacts on the fishing and shell-fishing activities that play an important economic role in this region. The liability of the ship-owner is in this case limited to Pesetas 1 121 million (5,4 million 2001 Pounds). The IOPC Fund intervention is limited to Pesetas 9 513 million (36,8 million 2001 Pounds). Compensation for the damages caused by the accident is on-going, with a large number of claims dealt with both under the CLC and IOPC Fund regime and in Spanish courts.

The **Braer** went aground on the 5th of January 1993, South of the Shetland islands in the United Kingdom. 86 500 tons of oil were spilt in this accident, with little direct impact on the coastline due to the action of the weather. Some 40 square kilometers of pastures were contaminated on the South-Western coast of the islands. The spill led to a ban on the catch and sale of fish and shellfish along the Western coast of the islands, the economy of which is strongly dependent on the fishing and aquaculture industry. The ship-owner's liability in this

[1] The United States have developed a different regime of liability and compensation, outside these international Conventions. For a discussion of how this regime compares to the CLC and IOPC Fund Conventions see De La Rue (1993) and Chao (1996).

[2] Fontaine (1993); France had not ratified the 1971 Fund convention providing access to a supplementary Fund.

case was limited to 4,9 million British Pounds (equivalent to 5,7 million 2001 Pounds, based on the official UK price index). The limit to the IOPC Fund's intervention in this case was set at 50,6 million Pounds (62,3 million 2001 Pounds). Compensation operated fairly rapidly under the CLC and IOPC Fund regime, until the third year after the spill, when large claims were logged against the IOPC Fund in Scottish courts. This lead to the interruption of all payments to claimants until 2000. With litigation procedures coming to a conclusion, it appears that compensation will be possible within the Fund limit.

The **Sea Empress** ran aground on the 15th of February 1996, at the entrance of the port of Milford Haven, in South Wales in the United Kingdom. 72 000 tons of oil were spilt in this accident, contaminating 150 km of coastline in a region popular for tourism and recreational activities, and holding several land-based and marine protected areas. As in the Braer accident, a ban on commercial and recreational fishing was imposed following the spill. The ship-owner's liability was limited to 7,5 million pounds (8,5 million 2001 pounds), and the IOPC Fund's intervention to 51 million pounds (57,9 million 2001 pounds). Compensation of most of the claims arising from this accident was dealt with in a relatively short period of time, under the CLC and IOPC Fund regime.

The **Erika** broke in two off the Atlantic coast of Brittany in France, on the 12th December 1999. Approximately 19 800 tons of oil were spilt in the marine environment. The oil started reaching the coast at the end of December, polluting 400 kilometers of coastline. Compensation for the damages arising from this accident are currently under way within the revised CLC and IOPC Fund regime of 1992, which provides for higher levels of payments than under the original texts of the Conventions. The ship-owner's responsibility in this case is limited to 84,2 million French Francs (8,1 million 2001 Pounds), and the IOPC Fund's intervention to 1 212 million French Francs (116,8 million 2001 Pounds).

Based on published and unpublished economic studies that were carried out with respect to these accidents, and available reports on the compensation process that followed the spills, we compiled global statistics concerning the amounts claimed and compensated, along with spill cost estimates where these were available. Table 1 summarizes the numbers found for each accident.

Table 1 – Global cost estimates, compensation claimed and compensation paid in six major oil spills in Europe, at the end of 2001 (£ million).

		Amoco Cadiz	Tanio	Aegean Sea	Braer	Sea Empress	Erika
	Date of accident	1-3-78	7-3-80	1-12-92	1-1-93	1-2-96	12-12-99
	Quantity of oil spilt (tons)	220 000	13 500	80 000	86 500	72 000	19 800
	Contaminated coastline (km)	350	200	100	40 km²	150-200	400
	Duration of compensation process	13 years	8 years	≥ 9 years	8 years	≥ 5 years	≥ 2 years
	Number of claims	n.a.*.	≅ 100	≅ 4 600	≥ 2 270	≅ 1 200	≅ 5 600
(a)	Estimated global cost of damages	[430,6-494,2]	n.a.*	n.a.*	n.a.*	[68,1–129,3]	[526,2-611,0]
(b)	Total compensation claimed	469,9	110,7	233,1	154,4	56,0	83,2
(c)	Total compensation paid	91,4	34,3	11,0	57,8	34,7	15,1

*n.a.: not available.

(a) and (b): values for the year of the spill, converted to 2001 monetary units based on official price indexes for Spain, France and Great Britain, and into £ million assuming the following average exchange rates: £1 = FF10,5521 and £1 = Pta267,6575.

(a) = existing global estimates of total cost to third parties, excluding the cost of lost cargo and ship.

(c): values at the date of payments made during the process of compensation, converted to 2001 monetary units based on official price indexes for Spain, France and Great Britain.

Sources

Amoco Cadiz: compiled from the following sources: Anonymous (1982); NOAA (1984); Bonnieux and Rainelli (1991); Henry, personal communication; archives of the Union Départementale des Associations Familiales du Finistère.

Tanio: compiled from IOPC Fund reports of meetings.

Aegean Sea: compiled from IOPC Fund annual report (2000) and reports of meetings; (c) = compensation paid at the end of 2001 by the IOPC Fund and the P&I Club.

Braer: compiled from IOPC Fund annual report (2000) and reports of meetings. (b) = payments by the IOPC Fund and the P§I Club at the end of 1995, and claims in courts early 1996; (c) = compensation paid at the end of 2001 by the IOPC Fund and the P&I Club.

Sea Empress: compiled from IOPC Fund annual report (2000) and reports of meetings. Estimate of damages by Moore L.Y., Footitt A.J. et al. (1998). (b) = total claims to the Fund and claims in courts; (c) = compensation paid at the end of 2001 by the IOPC Fund and the P&I Club.

Erika: compiled from IOPC Fund annual report (2000) and reports of meetings; (b) = total claims to the Fund; (c) = compensation paid at the end of 2001 by the IOPC Fund and the P&I Club.

Information in this table confirms that there is usually a divergence between the three categories of figures, the amounts claimed and paid being usually lower than the estimated costs.

Similar results can be observed with respect to more specific impacts of oils spills. Hence, in the Amoco case, detailed analysis of the process of damage assessment and compensation (Hay and Thébaud, 2002) shows that, while cleanup and restoration costs were estimated at £169,8 million, only £157,9 million were claimed for compensation in court, of which £78,6 million were eventually paid.

Similarly, pure economic losses were estimated at £65,5 million but only £38,0 million were claimed in court, and £11,0 million eventually granted to claimants. The total cost of the Amoco oil spill to the tourism industry was estimated at between £32,8 and £66 million. Firms from the tourism industry claimed compensation of approximately £3,9 million in court; the French State also claimed compensation of £0,9 million corresponding to payments made to the tourism industry following the spill (United States District Court, 1988). The final payments received by these claimants were respectively of £0,6 and £0,4 million.

Taking the lowest estimate of the total cost to the tourism industry as a reference, the final allocation of this cost can then be calculated as £1,1 , £0,5 and £31,2 million for the oil company, the French State and the private firms in the tourism business respectively.

Factors explaining the existence of diverging cost estimates: preliminary analysis.

Further analysis of the case studies allowed to identify two categories of factors explaining the diverging numbers found, at various stages in the process of damage assessment and compensation. These relate to (i) problems encountered in determining the monetary values of compensation; (ii) the strategic behavior of agents involved in the compensation process.

First, at least in large spills, the context in which economic studies are carried out is usually one of crisis requiring quick answers to the question of damage quantification, on the basis of data of variable quality. More than anywhere else, damage valuation in such context is constrained by the availability of basic empirical information on the activities affected, with consequences in terms of cost estimates. Furthermore, the assessment and compensation of costs arising from these oils spills is carried out in an *ad hoc* institutional context following rules established by the international conventions.

Second, while damage valuation may be carried out with the purpose to establish a basis for the compensation of victims, it only enters as information in the compensation process. In the accidents studied, individual victims display various strategies with respect to the decision to claim for compensation and to the amounts claimed, which may lead to substantial divergence between cost estimates, and actual claims and compensation paid.

A preliminary discussion of both factors is presented below.

Valuation problems and institutional constraints

Two sets of related issues are involved at this level. First, empirical problems in applying economic valuation methodologies following the spill can help explain in part the existence of diverging cost estimates. Second, the institutional context in which the compensation of damages is processed also plays a key role as it defines practically the type of damages qualifying for compensation, and the principles applying to their costing.

Empirical difficulties in valuing the costs of damages

Aside from the costs linked to loss of ship and cargo, economic impacts of oil spills can relate to one of several categories:

(i) Expenses are usually incurred in relation to preventive measures and clean-up operations on the coast. The former are taken to prevent oil from reaching the coast and to disperse oil at sea, while the latter aim at limiting damages once the oil has reached the coast.

(ii) Oil may pollute private and public property, entailing a reduction in the value of property (usually measured, for produced goods, by cleanup costs or costs of replacement if cleaning of the polluted property is not feasible; see Shavell, 1987).

(iii) Commercial businesses may be affected by the pollution, independently of whether they own property that has been polluted; and consumers may be affected by the spill either directly, e.g. loss of amenity or health effects for coastal residents, or indirectly, e.g. impacts of the pollution event on markets for fish food or tourism.

(iv) Finally, the ecological impacts of an oil spill may in themselves entail welfare changes. Such impacts often lead to undertake reinstatement measures attempting, at some cost, to accelerate the process of ecological restoration (and limit the welfare losses) following a pollution event.

The general approach to valuing *individual* damages caused by an accident in any of these categories appears fairly straightforward. In principle, it should be based on individual economic information concerning each agent's characteristics and activities, and how they relate to markets for goods and services in the economy impacted by the spill (see e.g. Ward and Duffield, 1992). By comparing what is observed before, during and after the spill to a baseline scenario of what should have taken place had the spill not occurred, it is then theoretically possible to establish individual welfare changes due to the pollution event. For non-market changes, recourse to specific valuation methodologies may be warranted (see e.g. Bonnieux and Rainelli (1991) for the Amoco Cadiz, and Moore L.Y., Footitt A.J. et al. (1998) in the Sea Empress case).

In practice, the approach is confronted to two major empirical difficulties which partly explain the existence of diverging estimates of the costs of damages.

1. *Lack of empirical information*.

   First, in most of the cases studied, valuation of damages is confronted with a lack of adequate empirical foundation, the information needed being either too fragmentary, or too costly to collect for all the agents affected in all the areas impacted by the spill. This seems to be particularly the case for basic economic data. In those cases where economic studies of the value of damages were carried out, the lack of economic information at the individual level often led authors to use indirect valuation methods, based on global assumptions about the economic structure of a particular activity. For example, in the case of the Amoco Cadiz, lack of detailed information on the level of economic activity of firms operating in the tourism industry led economists to use indicators such as wages paid by firms or local sales of flour to assess the global impact of the oil spill on this sector. A similar approach was required in the case of the shellfish growing industry, in the absence of individual data on companies involved in this production.

2. *Choice of the baseline scenario « without spill ».*

   Even where economic information is available at the individual level, results of the assessment prove highly sensitive to the choice of the baseline scenario on what would have occurred had the spill not taken place. This is all the more the case as economic changes due to pollution are of limited scale, in comparison to key ecological and economic processes determining the dynamics of activities in the polluted area. From the analysis of the case studies, it appears that it may prove particularly difficult to distinguish local effects related to the spill from other factors of variation in ecosystems (e.g. meteorological factors or hydrological factors affecting fisheries) and human activities (e.g. fluctuations in exchange rates affecting the tourism industry at national or European level). The consequence is that it may prove difficult to select one of several assumptions based on the available evidence, although these assumptions lead to significantly different results in terms of costs of the damages assessed.

3. *The choice of valuation methodologies*

   In some cases, additional variation in cost estimates at the assessment stage may arise from the choice of valuation methodologies themselves, rather than from issues of data availability or choice of scenario. This seems to be particularly the case with respect to the valuation of the non-market impacts of spills, for which different methodologies can be applied. To the extent that such damages were not taken into account in the compensation rules applied to the cases studied (for reasons other than assessment difficulties, see infra), it appears that debates on this aspect of the assessment remained mostly academic in those cases, the only consequence being the production of bracket, rather than target, cost estimates.

Established rules for compensation

Except for the Amoco case, compensation for the costs of damages in the cases studied was carried out under the CLC and IOPC Fund Conventions, which define a number of rules and procedures for the treatment of claims.

These rules and procedures partly explain the divergence between cost estimates, the amounts claimed, and those eventually paid to the victims of the oil spills considered in this study. Two examples can be used to illustrate this. The first relates to the interpretation of the notion of pollution damage; the second to the consequences of the limitation of payments instituted by the Conventions.

1. *Definition of pollution damage.*

   The compensation system operates on the basis of a definition of the notion of pollution damage which serves to delimit the domain of admissible claims[3]. As stressed by Jacobsson (1993, p48), while the definition of 'pollution damage' under the original CLC and Fund Conventions was not entirely clear, the IOPC Fund developed certain principles as regards the interpretation of this term in practice, based on its experience. In particular, debates on this issue with respect to particular claims and in intersessional working groups

[3] The term is defined in the 1992 conventions as "loss or damage caused outside the ship by contamination resulting from the escape or discharge of oil from the ship, wherever such escape or discharge may occur, provided that compensation for impairment of the environment other than loss of profit from such impairment shall be limited to costs of reasonable measures of reinstatement actually undertaken or to be undertaken" (1992 IOPC Fund claim manual).

of the Fund[4] have led to the establishment of certain principles as regards claims for pure economic loss, and for ecological damage.

Under the IOPC Fund system, claims for pure economic loss (ie loss of earning sustained by persons whose property has not been polluted) may be accepted only if there is a reasonable degree of proximity between the contamination and the prejudice for which compensation is claimed. Amongst other factors, this is assessed in terms of the geographical proximity between the activities of the claimant and the contamination, and the degree of integration of the claimant's activity in the economy of the area affected by the spill. This can lead to reject the claims for compensation of firms that are either based too far away from the spill area, or that do not contribute substantially to the local economy, independently of the capacity for the firms to establish a causal link between the contamination and an economic prejudice[5].

Under the IOPC Fund system, claims related to ecological damage are accepted if they can be measured in terms of financial costs incurred in association with (reasonable) measures of re-instatement of the environment following a spill. This implies that claims for non market losses based on the use of valuation techniques such as the travel cost method or contingent valuation, or on global estimates of the costs of ecosystem changes using benefit transfer techniques (such as were calculated in the global economic valuation study carried out in the Sea Empress case) can not be accepted[6]. A similar problem applies to other non monetary costs such as losses of amenity and recreational benefits[7]. A related condition for claims to be acceptable is that they originate from agents who effectively supported financial costs in relation to reinstatement measures. A similar issue arose in the Amoco Cadiz case, which was dealt with in American court. In this case, the claim for 160 million 1978 French Francs (42,4 million 2001 Pounds) by the local authorities in relation to lost biomass due to the spill was rejected since this biomass was considered *res nullius* by the judge, hence no legitimate claimant existed to whom such compensation could have been paid.

2. *The impact of limited compensation*

The existence of a global limit to the amounts payable by the IOPC Fund has only become a constraint on the compensation process in very large oil spills. The principle applied in these cases is that all claimants should be treated equally with respect to the consequence of this limitation on their individual claims. In practice, the implication is that accepted claims are only compensated up to a percentage defined by the ratio of the global payment limit to the total accepted claims. In the case of the Tanio, this led to payments of two thirds only of the accepted claims. In more recent accidents such as the cases of the Aegean Sea or the Erika, anticipating that the payment limitation might be exceeded has led the Fund to limit payments in the early stages of the compensation process, until it

[4] See reports of the 7th working group of the Fund, devoted to the analysis of general criteria for the admissibility of claims for compensation, published by the IOPC Fund in 1993 and 1994.

[5] In the Sea Empress case, for example, claims for shellfish dealers and processors based several hundred kilometers away from the spill area were rejected in application of this principle.

[6] In a resolution adopted by the General Assembly of the Fund in its first extraordinary session in October 1980, it was agreed that compensation payable by the Fund should not be based on « abstract quantification of damage calculated in accordance with theoretical models ».

[7] For example, in the Erika case, the cost of pollution to recreational fishermen was estimated by Bonnieux and Rainelli (2003) at approximately 100 million euros. This cost is not taken into account by the international liability and compensation system of oil spill damages.

became fairly certain what the total amount payable by the fund would be, and what final percentage of accepted claims could be safely paid.

Strategic behavior of agents involved in the compensation process

A second important factor explaining the divergence between cost estimates, claims and final payments relates to the behaviour of agents involved in the compensation process. This concerns both the decision by victims to claim compensation, and the impacts on claims of constraints relating to the material proof of damage.

The decision to claim for compensation

Under the IOPC Fund regime, claims for compensation are treated individually, although claimants can work collectively to establish their claims[8]. A claimant is required to prove his claim by producing various documents to support his position (Jacobsson, 1993, p47). The analysis of the case studies shows that the global amount of compensation claimed for by victims of oil spills tends to be regularly lower than the total cost estimates arising from valuation studies. Except where valuation studies are used explicitly as a basis for establishing claims for compensation, the same applies to specific damages sustained by victims.

A simple model of the decision to claim compensation when affected by an oil spill can be postulated to explain this[9]. The decision can be interpreted as a function of:

- the anticipated costs to be supported by individual victims when making a claim. These costs can be financial (e.g. costs of legal assistance or of expertise, some of which may depend on the outcome of the compensation procedure) [10], and in terms of the time and trouble involved;
- the benefits expected by individual victims from the procedure, these being a function of the anticipated chances of success, and of the level of compensation expected if the claim is successful.

Potential claimants may abandon the idea of claiming compensation, where the expected benefits exceed the expected costs. While this problem seems an important element in understanding why cost estimates differ from compensation claims in the cases studied, there has been a limited number of empirical studies attempting to quantify its role in practice[11].

The costs and benefits anticipated by individual victims with respect to claiming compensation may be influenced by various elements pertaining to the context in which such decisions are taken. These elements include the rules defining compensation procedures, the level of information of victims on these rules, the possibility for individuals to benefit from and be influenced by external assistance, and the capacity of victims to work collectively in establishing their claims, even if these are then submitted individually.

Grouped strategies as regards the establishment of claims, such as the creation of an association of victims, or the representation of several victims by a single consulting firm

[8] As in the Amoco case.

[9] See Shavell (1987, chap. 11) for a discussion of this issue in the context of accident law.

[10] Under the IOPC Fund rules, the financial costs incurred to substantiate claims may at least partly be claimed back from the Fund.

[11] See e.g. Hay, Thébaud et al., 2002 for an analysis in the Erika case.

allow better information of the victims, and a possibility for representation costs to be shared. But the existence of these initiatives depends on the capacity for individual agents to engage in collective action. Analysis of the case studies showed that this may prove difficult in practice when the number of agents concerned is high and/or when the agents are affected in a fairly heterogeneous way by the pollution event[12].

It also appears that in a number of cases, potential claimants anticipate that they have little chances of being successful in proving the existence of a direct link between the oil spill and the damages they may have sustained, particularly when they are located far from the polluted area, or far down the chain of the economic activities affected by the pollution. This seems to be particularly the case for the service industry, in sectors such as tourism or trading in seafood products.

The existence of limited compensation under the IOPC Fund Convention also has an impact on the decision to make a claim. Whereas it could, in the case of very large oil spills, incline some victims to claim excessive amounts of compensation, anticipating the pro rata rule as described before, it has also constrained some victims to make a claim, considering other persons needed priority. In the aftermath of the Erika oil spill, both the French state and TotalFina Elf company announced they would not ask compensation for the costs incurred as long as private victims were not fully compensated, as announced the English state after the Braer oil spill.

Information asymmetry and proof of damage

Variations in cost estimates, linked either to the choice of the baseline scenario, to the assumptions made where individual data is lacking or to the choice of an economic valuation methodology, also have direct consequences on the presentation of claims for compensation. Given the debated nature of the compensation process, uncertainty in the costing of damages increases the possibility of using numbers strategically. As a consequence, it is usually required from the claimant to produce pieces of evidence in order to prove the damage and to justify the amount claimed. The better the quality of the evidence provided, the higher the chances that the claim will be accepted.

In practice, this can introduce a degree of heterogeneity in the status of claims, some of them (clean up and removal costs for instance) being more likely to be well documented (in terms of both existence and extent of the cost) than others (e.g. pure economic losses), and the latter being more difficult to sustain as a result.

Concluding remarks

Preliminary analysis of the process of damage assessment and compensation following six major oil spills in European waters confirms that it may prove difficult to agree on a single estimate of the costs of an oil spill in practice. The consequence appears to be that part of the estimated costs of the spill are not internalized via the international liability system.

Two categories of factors help to understand why this may occur: (i) empirical difficulties and regulatory rules as regards the costing of damages, and (ii) the strategic behavior of agents involved in the compensation process. These factors are not independent. Measurement

[12] See Hay and Thébaud, 2002, for a discussion of this issue in the Amoco case.

difficulties make for the possibility to use numbers strategically, hence the recourse to various procedures for substantiating claims, which may themselves influence individual decisions to claim compensation.

Such knowledge is essential in discussions concerning the effectiveness of liability rules *in practice*. In addition to greater insight regarding the signification of the different numbers that arise from any particular spill, further exploration of the influence of these factors provides a useful analytical framework to assess the possible consequences of current debates on the revision of the existing liability and compensation system.

First, following the Erika spill, debate has centred in particular on two aspects of the compensation regime:

- Increase of the maximum liability payments available for any particular spill: an increase of the existing maximum liability by 50% will be effective in November 2003, and the creation of a complementary level on a voluntary basis is currently being discussed within IOPC. This can reduce the possibility that, in exceptionally costly spills, the sum of compensable costs be above the available liability limit;
- Definition and interpretation of the categories of costs accepted for consideration by the international system: discussions have in particular focused on the interpretation of costs related to ecological damage (costs of damage assessment and restoration measures in particular). Extending the categories of damages accepted for compensation under the existing regime can allow a greater proportion of the costs of oil spills to be internalized, irrespective of the global magnitude of damages caused.

A second dimension of the debates that followed recent spills, at least in France, has to do with the quality of national systems in place for the monitoring of coastal ecosystems and activities. While there will always remain a degree of unknown in the exercise of valuing the ecological and economic impacts of a spill, improving the quality of baseline information that can be used in such assessments can play a significant role in narrowing uncertainty around the estimates, and limiting the ensuing difficulties in dealing with compensation claims. An issue here concerns the possibility that such permanent monitoring activities be at least partly taken into account in assessing the costs of pollution.

Finally, the first results of this study also point to the importance of accompanying measures that aim at improving the information of claimants on the process of compensation, and at easing the settlement of claims (conciliation), in the proper functioning of the liability system.

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