Nonmarket Valuations of Accidental Oil Spills: A Survey of Economic and Legal Principles

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Abstract This paper presents an overview of legal and economic theories used to assess liability and damages for loss of nonmarket goods arising from an accidental oil spill. Several different economic methods used for quantifying values are discussed and critiqued. Also reviewed are the fundamental legal doctrines that permit individuals and public agencies to seek compensation for these damages. To illustrate the applicability of these economic and legal theories, two case studies are presented and evaluated in terms of the principles presented earlier.

Introduction

Accidental oil spills usually receive considerable public attention and concern because of the damages to biota and natural resources and the losses suffered by individuals and by business owners and employees. The proper measurement of economic damages from oil spills requires that economically defensible and empirically feasible estimates of losses be developed. However, the actual resolution of

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damage claims, via compensation of victims, requires the existence of a legal-institutional structure within which damage claims can be adjudicated. Despite the critical interplay of economic principles on the one hand and legal principles on the other, there have been relatively few attempts to relate economic and legal issues arising in the context of accidental oil spills (see, e.g., Brown, 1982; Jimenez, 1982; Halter and Thomas, 1982; and Sorensen, 1976a,b).

This paper is an attempt to integrate the economic and legal analysis of the nonmarket-valued losses suffered as a consequence of accidental oil spills. We first present a brief outline of the economic methods used for estimating nonmarket-valued losses. We then outline the legal principles used to determine the compensation due to those who have suffered from oil spills. Next we analyze the legal and economic applications of the Santa Barbara Channel spill and the grounding of the SS *Zoe Colocotroni*, based on the principles developed earlier. The last section consists of an overview and summary.

Economic Methods for Estimating Nonmarket-Valued Losses

The market costs of accidental oil spills are generally estimable, since the market value of the materials and labor used in cleanup are fairly easy to establish.[1] The estimation of nonmarket values, however, poses several problems, especially in connection with damage to public recreational sites and to noncommercial biota. When recreational facilities are provided by the private market, the losses to users and owners of the facilities or resources are estimated on the basis of market prices. It is much more difficult to estimate the value of losses when an accidental oil spill causes damage to publicly owned facilities, wildlife, and recreational fisheries, precisely because these "goods" are not traded in private markets. Yet these losses must be estimated. Otherwise, we are implicitly assuming these nonmarket goods have zero value, an unjustifiable assumption.

Several methods have been developed for use in quantifying nonmarket values (and hence, damage costs). These include (1) gross expenditure approach, (2) market value of catch method, (3) cost method, (4) value of services method, (5) replacement cost approach,

(6) willingness-to-pay method, and (7) the hedonic pricing method. The first three methods are without economic merit, and for this reason will be discussed only briefly. The willingness-to-pay method will be discussed in more detail because it is fundamentally sound (though in practice it may produce unreliable results)[2] and because it has been widely used in many situations involving nonmarket public goods. The hedonic pricing method represents a relatively recent development in economic theory, but the data requirements of this method severely limit its practical applicability.[3]

The Gross Expenditure Method

This method views the total expenditures incurred by individuals in the process of visiting a recreational area as a good measure of the value of benefits received from the area's recreational facilities. The basis for this method is the principle that the benefits must be approximately equal to the gross expenditures, or the consumer would not have "purchased" this good. Clearly, this method cannot be justified on the basis of economic theory. While gross expenditures may provide an estimate of the minimum level of benefits, the actual level could be much higher than the gross expenditure. As illustrated in Figure 1, for the demand curve $D_1(WQ_1)$, there is a consumer surplus equal to the area P_1AB which is not measured by using the gross expenditure method. Moreover, this approach cannot account for the marginal value of the recreational site (nor the marginal loss from damage to it).

The Market Value of Catch Method

This method estimates the value of recreational harvests by using the market value of the catch. Once again, this method may provide an estimate of the minimum level of benefits, but it obviously ignores the benefits individuals get from the hobby itself. This approximation is likely to provide unreliable estimates.

The Cost Method

The cost method assumes that the value of the recreation site is equal to the cost of operating it. The basic flaw in this method is that it does not focus on consumer behavior and, consequently,

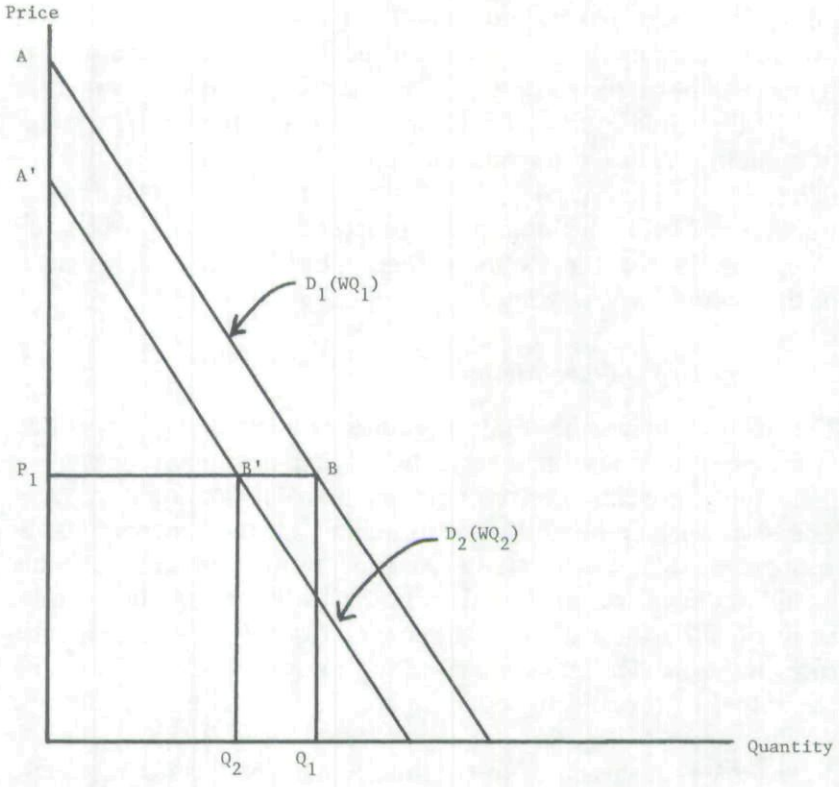

FIGURE 1. Simplified representation of a loss of benefits as a result of oil spill. (Adapted from Smith et al., 1983.)

this method has no basis in economic theory. Further, in the context of publicly provided goods, this would be an extremely dangerous principle to accept since it provides justification for any and all investments in the production of the public goods.

The Value of Services Method

The value of services method uses a schedule of charges for all the services offered as an estimate of the value of these services. The charges are based on the assumed market value of the services. If the imputed values are based on previous, theoretically sound economic studies, this approach does have some merit. Moreover, this method focuses on the consumer's willingness to pay for the services,

and on this basis it is superior to the three discussed earlier. The practical problem it poses is to compute reasonable market prices for services that are inherently noncommercial.

The Replacement Cost Method

The replacement cost method values losses by estimating the cost of replacing damaged biota. One approach that has been used to establish the cost of replacing noncommercial biomass has employed the price lists of firms supplying organisms for experiments or animals for zoos. For example, according to Brown (1982), California uses a replacement cost of $0.25 for sea urchins.

The major problem with the replacement cost method is that the price of an organism sent to a lab, or of an animal sent to a zoo includes the costs of collection and transportation as well as a normal level of profit. Since these costs are not present with naturally occurring biota, the replacement cost method overestimates the value of lost organisms in situ.

The Willingness-to-Pay Method

The willingness-to-pay (WTP) method focuses clearly on consumer behavior, and attempts to estimate a demand curve for the product, just as if consumers were purchasing recreation in the private market. The method then estimates the value of benefits lost, by applying to the "pseudodemand" curve the same measure that is applied to actual demand curves for market-oriented commodities, consumer surplus.

The objective of the WTP method is to place a dollar value of this loss of surplus. For example, as shown in Figure 1, if water quality deteriorates from WQ_2 to WQ_1, the demand for the resource declines, resulting in a leftward shift in the demand curve. If the imputed price is P_1, this means a loss of surplus, shown by the area $A'ABB'$. This is the area WTP estimates.

Consumer surplus, of course, is an approximation of the more fundamental measure, compensating variation in income. Strictly speaking, for normal goods consumer surplus will always be greater than the compensating variation measure, and so will be an overestimate of the value of benefits lost as a result of the fall in con-

sumption of the particular commodity. In practice, however, this discrepancy is usually small relative to the other inaccuracies and approximations normally present in any empirical analysis and thus poses few problems.[4]

The practical problem in using consumer surplus for nonmarket goods is that there are no historical prices and quantities from which a demand curve can be established. Consequently, two types of approaches have been used to estimate people's willingness to pay for recreational facilities: (1) the direct survey approach, and (2) the travel cost approach.

Under the direct survey approach, a random sample of people affected by an accident is asked to indicate how much they are willing to pay to attain some stated incremental increase in site quality (or willing to accept as compensation for an incremental decrease in quality). The major problem with the survey approach is possible bias in the respondents' replies.[5] For example, a respondent who thinks his reply may affect his tax burden may understate his willingness to pay; or if the respondent believes that his reply will have no effect on his tax burden, he may overstate his willingness to pay, thus leading to strategic bias. Direct surveys are thus not entirely reliable.

The travel cost approach is an alternative way of estimating willingness to pay. As in the direct survey approach, a random group of visitors to a recreation site is selected and surveyed. From each member of this group, detailed information about the visitor's permanent residence, distance from residence to recreational site, and expenses for the visit (including hotel, food, and travel) is collected. Based on these parameters, site-specific values can be derived.[6]

As with the direct survey approach, the results obtained from the travel cost method are not entirely reliable. The implicit assumption in this approach is that all expenses incurred on the trip are for the purpose of visiting the site. However, the trip itself may be considered as a source of satisfaction by the visitor, meaning that part of the expenditures may be for "purchasing" the trip instead of the benefits from recreation. If the trip involves other stops, the expenditures may not have been made for the purpose of any single site visit.

The Hedonic Pricing Method

The hedonic pricing method is a generalization of the travel cost approach to estimating the willingness to pay. However, the concept of hedonic pricing is a fairly general one and has been applied to a wide variety of situations (see e.g., Rosen, 1974; Pollack and Wachter, 1975; Freeman 1979; and Brown, 1982).

In connection with recreational facilities, Brown (1982, p. 197) has noted:

> Hedonic analysis connects differences in characteristics (of a site) to differences in expenditures individuals incur to obtain sites with different characteristics. If a beach resembles all other beaches except that it is cleaner and costs $\$x$ more per person to enjoy, the $\$x$ must be the value of the added cleanliness for each person who gets to the clean beach. Why spend $\$x$ unless the extra cleanliness is worth it?

The hedonic pricing method is theoretically appealing, but its implementation imposes severe requirements. Data are needed to estimate the parameter of two sets of regression equations. In the first set, the amount of money spent on vacations is the dependent variable. The explanatory variables in this equation are vacation characteristics such as beach time, leisure time in the home, and touring time during the vacation. These are used to determine the implicit price of the beach time. This implicit price is used in the second regression equation to estimate the beach demand. This equation can then be used to estimate the welfare loss due to changes of beach quality as a result of the oil spill.

So far as we know, the hedonic pricing method has not yet been used to estimate nonmarket damages as a result of oil spills. The main difficulty, as stated, is the need for large quantities of data.

Compensation for Damages: A Review of the Legal Principles

This section discusses the fundamental legal doctrines that permit individuals and public agencies to seek compensation for damages from accidental oil spills, and the principles used by the courts to decide these suits. Unless explicitly stated to the contrary, all references are to U.S. law, although in many situations this law is

similar to the law of other countries. We also discuss in some detail a specific law, the Outer Continental Shelf Lands Act (OCSLA) Amendment of 1978, which relates to the management of resources of the outer continental shelf.

The damages caused by an oil spill can affect (1) commercial and/or noncommercial animal life, and (2) replaceable as well as irreplaceable resources. Generally, compensation claims for damages are usually for:

1. Cleanup costs. These claims may be filed by individuals or governments.
2. Loss of income as a result of damage to natural resources by oil pollution. These claims are usually filed by individuals such as fishermen.
3. Loss of income as an indirect consequence of oil pollution. These claims are usually filed by businesses that depend on tourism.
4. Damage to natural resources. These claims are usually filed by local, state, or national governments.
5. Loss of use of recreational facilities. These claims are usually filed by individuals who cannot pursue their hobbies as a result of oil spill.

Claims of Individuals for Compensation

Individuals usually seek redress for damages under the common law. The common law, or private law, is judge-made law decided in the courts on the basis of precedents, as opposed to statutary law, which is written by the legislature.

To receive compensation for damages under the common law, the plaintiff must show that there is an appropriate legal theory of liability and how this theory is applicable to his claim. There are several theories of liability under which a plaintiff may make a claim. These are:

1. The Law of Nuisance. Most claims relating to oil spills are based on this theory of liability, which will be discussed at length.

2. The Law of Negligence. Many claims relating to oil spills are based on this theory and, thus, this theory will also be discussed in detail.
3. The Law of Strict Liability.
4. The Writ of Trespass *quare clausum fregit*.
5. The Law of Admiralty.
6. The Law of Unseaworthiness.

The last three theories listed above will not be discussed in this paper because they are seldom used as bases for successful claims relating to oil spills. Full discussions of all of these theories can be found in Prosser (1966), McCormick (1935), and Gilmore and Black (1975).

The Law of Nuisance. The law of nuisance focuses on the damages or nuisance suffered by the plaintiff as a result of some action by the defendant. This theory differentiates between Private Nuisance and Public Nuisance. A claim can be filed under the Private Nuisance doctrine when there is interference with private use or enjoyment of land. In contrast, Public Nuisance requires interference with interests common to the public at large, and not necessarily with the interests of specific individuals.

Irrespective of whether the claim is filed under Private Nuisance or Public Nuisance, this doctrine requires that the nuisance be permanent or continuing for compensation to be granted. This permanency requirement has been applied in different ways by different courts in connection with oil spills. In the case of *Maryland v. Amerada Hess Co.* [350 F. Supp. 1060 (D. Md. 1972)], the court had to rule on a claim for compensation for an oil spill that occurred when a pipeline broke as it was transferring oil from a tanker to a terminal. After consulting Maryland case law on Public Nuisance, the court held that in each case examined there was an element of an ongoing phenomenon consisting of some recurring act or acts and/or a continuing condition (*Id.* at 1608).

On this basis, the court decided that a single instance of an oil spill did not constitute an "ongoing phenomenon," and the petition was denied. A similar interpretation was made by the court in *Cyr v. Town of Brookfield* [153 Conn. 261, 216 A.2d 198 (1965)].

However, other courts have not put the same emphasis on the continuing nature of the nuisance. In *Burgess v. M/V Tomano* [370. F. Supp. 247 (D. Me. 1973)], the court had to rule on claims for compensation for damages from oil leakage from a tanker in Casco Bay. The plaintiff's petitions were granted without any reference to "ongoing phenomenon."

For a Private Nuisance claim, there must be a direct interference with a private property. For this reason, owners of land or property near the shore which has been in contact with oil have used this doctrine successfully. For exactly the same reason, claims from owners of property situated near a shoreline but not directly bordering on it, have failed. Since the oil does not come into direct contact with these properties, a direct interference with private rights cannot be established.

Although the Public Nuisance doctrine is applicable to the interests of the public at large, an individual can bring a private action under this doctrine if "he has suffered damages particular to him—that is, damage different in kind, rather than simply in degree, from that sustained by the public generally" (see Prosser, 1966).

This doctrine is well illustrated by the decision of the court in *Burgess*. The oil leak from the tanker had affected commercial fishermen and clam diggers, and businesses dependent on the tourist trade. The fishermen and clam diggers could not seek compensation under the Private Nuisance doctrine, since they could not claim to own the sea or its produce.

The defendants argued that the Public Nuisance doctrine was also not applicable since everyone has a right to fish or dig for clams, not just those who actually do it for a living. These rights are "public rights" held in trust by the state, and are not private rights. However, the court declared that "the commercial fishermen and clam diggers in the present cases already have a special interest, quite apart from the coastal waters of the State of Maine" (*Id.* at 250).

Thus, in this case, the court applied the principle that "Pecuniary loss to the plaintiff will be regarded as different in kind where the plaintiff has an established business making a commercial use of the public right with which the defendant interferes" (see Prosser, 1966, p. 1007).

Under the Law of Nuisance, having a right to compensation in principle is not the same as getting the compensation in fact. The plaintiffs still must prove that any fall in profits is a direct result of the oil spill.

The Law of Negligence. Unlike the Law of Nuisance, this theory focuses on the behavior of the defendant. Historically, the Law of Negligence has been used in connection with damages sought for spills resulting from land-based oil drilling (see Keeton and Jones, 1956).

To successfully seek compensation under the Law of Negligence, the plaintiff must establish that (1) the defendant owed the plaintiff a duty of care, i.e., the defendant had the responsibility of taking care that the plaintiff did not suffer any loss due to the defendant's action; (2) the defendant breached this duty, i.e., the defendant was negligent; (3) the defendant's actions were the "proximate cause" of the plaintiff's damages, i.e., the defendant's actions were a sufficiently important cause of the actual loss to the plaintiff; and (4) the defendant could have foreseen the damages his actions caused, i.e., the defendant knew what harm his conduct would bring about. In other words, the plaintiff, usually a private citizen, has the "burden of proof"; he must establish "negligent conduct" on the part of the defendant by showing what went wrong to cause damage. This also applies to maritime vessels.

To reduce the heavy burden for the plaintiff, the courts have increasingly relied on the doctrine of *res ipsa loquitor*, which literally means "let the matter speak for itself" (see Prosser, 1971). Under *res ipsa loquitor*, the plaintiff has to show only that he was injured, and that the defendant's actions did contribute to his (the plaintiff's) injuries. It is then up to the defendant to prove that he was not at fault.

In this way, the doctrine of *res ipsa loquitor* is tantamount to a reverse burden of proof. In effect, the defendant, who is assumed to be more knowledgeable about what went wrong on the vessel or drilling operation (which may be highly technical) has to prove that he was not negligent.

The doctrine of *res ipsa loquitor* has been used in several cases (see, for example, *California v. SS. Bournemouth* [318 F. Suppl 839

(C.D. Cal. 1970)]. It proved especially applicable in *Skansi v. Humble Oil and Refining Co.* [176 So. 2d 236 (La. Ct. App. 1965)]. In this case, the defendant, an oil company, had appealed a decision against it for the loss of oysters due to oil pollution allegedly caused by oil-drilling activities, In making its decision, the court accepted the testimony of an expert witness that the leakage of oil was an indication that the drilling equipment was not functioning as it should have. The malfunction was taken by the courts to be sufficient evidence of negligent conduct; the matter spoke for itself, *res ipsa loquitor*. But for the malfunction, the pollution "would not have occurred except for some fault or negligence on defendant's part" (*Id.* at 238).

After negligence has been established, the plaintiff still has to show that the defendant's conduct was a sufficiently important contributory factor to his damage. This can be quite difficult to establish in cases relating to oil spills. Finally, as indicated earlier, the plaintiff must also prove that the defendant could have foreseen that his actions would lead to the type of damages that occurred.

The Law of Strict Liability. The fundamental notion behind this theory is that those who undertake abnormally dangerous activities should be held strictly liable. The doctrine of Strict Liability was first enunciated in the English case *Rylands v. Fletcher* [L.R. 3 H.L. 330 (1968)].

This doctrine had been historically applied to land-based oil drilling, but the OCSLA of 1978 (described later) has extended it to offshore activities. A good example of the application of strict liability is found in *Green v. General Petroleum Corp.* [205 Cal. 328, 270 P. 952 (1928)]. In this case, the plaintiff sought compensation for the damage caused by oil, gas, rocks, and other debris that had been deposited on his property as a result of a blowout. The court ruled in favor of the plaintiff, on the basis of the argument that:

> Where one, in the conduct and maintenance of an enterprise lawful and proper in itself, deliberately does an act under known conditions and, with knowledge that injury may result to another, proceeds, and injury is done to the other as the direct and proximate consequence of the act, however carefully done, the one who does the act and causes

> the injury should, in all fairness, be required to compensate the other for the damage done. (*Id.* at 333–34)

Note that the doctrine of Strict Liability does not apply absolute liability on the part of the defendant; i.e., in some instances the defendant may not be held liable. For example, the defendant is not liable if the injury is due to storms, earthquakes, or other natural disasters, all of which are known as Acts of God.

The defendant is also not liable for the independent acts of a third person that he could not have foreseen or prevented (see Prosser, 1971 p. 321). This is clearly illustrated in the case of *Bianchini v. Humble Pipe Line Co.* [480 F.2d 251 (5th Cir. 1973)]: the defendant was not held liable when an unknown vessel struck a pipeline, resulting in oil leakage. Although no cases have been decided under this law, it is also held under OCSLA 43 U.S.C. 1814(c) that the defendant is not liable for acts of a third party if (and only if) the damage is due solely to the third party.

Claims of States for Compensation[7]

In an increasing number of oil spill cases, states have filed claims for compensation for damage to wildlife and vegetation. This has led to a controversy as to whether a state has any right to seek redress for damages to things which technically it does not own.

In legal terminology, the right to sue is called a "right to action." In order to have a right to action, the plaintiff must show that he has (1) "standing" and (2) cause of action. "Standing" is the legal term for whether or not the plaintiff is the person who properly should seek compensation for the damage that has been done; if the plaintiff is the proper person, then the plaintiff is said to have "standing." For a person to get standing, it is enough to show that he "has sufficient stake in an otherwise justiciable controversy to obtain judicial resolution of the controversy" [see *Sierra Club v. Morton*, 495 U.S. 727, 731 (1972)].

"Cause of action" refers to the facts that give a person the right to sue. Technically, it refers to a "situation or state of facts which would entitle a party to sustain an action and give him the right to seek judicial interference in his behalf" [see *Thompson v. Zurich Insurance Co.*, 309 F. Supp. 1178, 1181 (D. Minn. 1970)].

In cases related to oil spills, states have used three doctrines to gain standing: (1) proprietary interest, (2) trustee of the public trust, and (3) *parens patriae*.

Proprietary Interest. Proprietary interest is "the interest of an owner of property together with all rights appurtenant thereto" [*Black's Law Dictionary* 2098 (5th Ed. 1979)]. Simply put, if a state has a proprietary interest, it has the same interests as an owner. Since it is a basic tenet of the common law that owners of property can sue for damages, if a state can show it has a proprietary interest, that would give it a right to sue.

Early case law, for example *Greer v. Connecticut* [161 U.S. 519 (1896)], equated proprietary interest with ownership. However, this notion has been rejected in more recent cases. The decisions in *Hughes v. Oklahoma* [441 U.S. 322 (1979)] and *In re Steuart Transportation Company* [No. 76-697-N (E.D. Va. July 1977 and Feb. 1980)][8] clearly state that neither the federal nor the state government "own" living natural resources. In spite of this, the courts held that they do have an important interest in them.

Trustee of the Public Trust. A "trust" is "a right of property, real or personal, held by one party for the benefit of the other" [*Black's Law Dictionary* 1352 (5th Ed. 1979)]. A trustee has an obligation to ensure that the trust "corpus" is protected, i.e., remains intact, and to seek compensation for damages. A "public trust" is a trust in which the beneficiary is the public at large (see Sax, 1970).

In cases related to oil spills, the argument often used by the plaintiffs has been that the state is a trustee on behalf of the general public and, in this role, has an obligation to protect wildlife and marine life. Consequently, the state has a right to seek compensation for damage to wildlife and marine life by oil pollution.

Parens Patriae. Literally translated, *parens patriae* means "parent of the country." This doctrine was established in England as the king's right to protect those of his citizens who were incapable of looking after themselves. In the United States, *parens patriae* refers to a situation in which the state claims compensation for "quasi-

sovereign" interests which are distinct and apart from injuries suffered by its individual citizens.

Generally, for a state to show that the *parens patriae* doctrine applies, one of the following two conditions must be met:[9]

1. The state suffers injury which is easily seen, such as to its economy, or
2. The public at large suffers injury, but no specific individual has the right to recover.

Nation-States' Claims for Compensation

International law, regarding the rights and responsibilities of nation-states when an oil spill occurs on the high seas, has changed considerably since the *Torrey Canyon* incident in 1967. Some changes were introduced by the Intergovernmental Maritime Consultative Organization (IMCO) Legal Committee resolutions of 1969. The major changes, however, were brought about by the Tanker Owner's Voluntary Agreement on Liability for Oil Pollution (TOVALOP). A complete description of recent international activities in this area is found in M'Gonigle and Zacker (1979).

Before the *Torrey Canyon* incident, no major oil spill affecting a coastline had occurred on the high seas, and the law was not comprehensive. One major weakness of the law was that it did not make clear who the party was against whom legal action should be sought; the reason was that tanker operations involve citizens of many countries, along with a complicated set of legal and financial relationships between corporations registered in different countries.

A second weakness was that the extent of the liability of the responsible person was not clearly defined. The 1957 Convention on the Limitation of Liability has set these limits at 1,000 gold francs (approximately $67) per ton of the ship's "limitation tonnage." However, no limit would apply if the ship's owner as well as the crew or captain was found negligent. In contrast to this, under U.S. law, the limit of the liability was set at the value of the ship and cargo *after* the accident.

A third weakness was that the rights of coastal nation-states to intervene on the high seas to protect themselves from oil pollution

were not clearly defined. Technically, no nation-state had a right to interfere in activities on the high seas. Moreover, the 1954 Convention on the Prevention of Pollution of the Sea by Oil stated that control over ships on the high seas belonged to the "flag" nation-state. Together, these provisions left the rights of coastal nation-states in a type of legal limbo, since most ships operated under 'flags of convenience," and not of the major coastal states.

The Outer Continental Shelf Lands Act Amendments of 1978

The 1978 Amendments to the Outer Continental Shelf Lands Act of 1953 (OCSLA) provide a much greater role for state and local governments in deciding how the resources of the outer continental shelf (OCS) should be managed.[10] Under Title III of the Act, liability for offshore oil pollution damage is placed squarely on owners and operators of vessels or offshore facilities. The Act also creates an Offshore Oil Pollution Compensation Fund to ensure that money is available for the speedy removal of spilled oil incurred during oil and gas exploration on the OCS. Administration of the fund is shared by the Secretary of Transportation and the Secretary of the Treasury. The fund is to be kept at between a minimum level of $110 million and a maximum of $200 million. It is financed primarily by a fee not greater than $0.03 per barrel on all oil produced on the OCS, although additional income is received from various fines, penalties, and interest income.

Title III allows recovery for removal costs and damages. A claim for removal costs can be made by any resident of the United States or any government body. Claims may also be made for damage to, or destruction of, real or personal property or natural resources. In addition, those who previously obtained at least 25% of their earned income from activities on the OCS but due to pollution damage suffer reduced profits or earning capacity are eligible for compensation. Both the President, in his capacity as "trustee" of the OCS resources, and any state government can claim for damage to or destruction of natural resources. Government bodies may also claim for the period of one year for loss of tax revenues as a result of damage to real or personal property. Also, the U.S. Attorney General can bring a class action on behalf of individual citizens.

The Act imposes strict liability for pollution damage, with a few exceptions, on the owners and operators of private vessels or offshore installations. Title III limits this liability to $250,000 or $300 per gross ton, whichever is greater. However, liability is unlimited if the damage is the result of wilful misconduct, gross negligence, or where there has been a violation of federal safety standards. Lability includes all removal costs incurred by the federal government or any state or local government. The owner or operator of an offshore installation is liable for total removal and cleanup costs plus an amount not exceeding $35 million for all other damages. The fund is responsible, without limit, for all damages and removal costs that are not compensated from other sources, except when there is gross negligence or wilful misconduct by the claimant, in which case he cannot recover.

Description and Analysis of Two Oil Spills

This section discusses two major oil spills which clearly bring out the problems involved in the application of economic and legal principles to actual cases. Both cases have been extensively analyzed, and both relate to the United States. Other incidents have also raised many serious questions, such as the *Torey Canyon* and the *Amoco Cadiz* spills, but these spills cannot be fully understood without discussing English and French law, respectively, and so they have been excluded from this paper.

For each incident the facts relating to the actual accident are presented first. Following this, the arguments and studies presented by the plaintiffs and the defendants in the resultant legal suits are explained and analyzed, using the economic and legal principles outlined in the earlier sections. In addition, consideration is given to studies of these incidents that have been conducted by independent experts.

The Santa Barbara Channel Spill

The Santa Barbara Channel spill involved an oil well blowout and a pipeline leak causing damages to harbors, aquatic life, shoreline property, and beaches. This occurred after a year of occasional seepages from the well. The spill occasioned the introduction of

novel legal theories of compensation for environmental damage of biological resources.

Description of the Santa Barbara Channel Spill. In January 1969, platform A in tract 4042, situated between the coast and a chain of islands, began intermittent leakages of oil. Union Oil operated platform A on behalf of a consortium including Texaco, Gulf Oil, and Mobil Oil. An estimated 3.3 million gallons of crude oil were released which eventually covered approximately 30 miles of beach.

Despite efforts, the oil could not be prevented from getting into the harbors, with consequent damage to boats and shoreline buildings. Commercial fishing stopped completely in January and did not begin again until April 1969. As a result of the spill, the U.S. Department of Justice ordered a four-year moratorium on drilling and production from platform A.

Analysis of the Santa Barbara Channel Spill. The Santa Barbara Channel spill has been extensively analyzed by economists, lawyers, and political scientists. This paper considers especially, among others, the works of Mead and Sorensen (1970), Mead and Wilcox (1974), Sorensen (1976a,b), and Mattson (1979).

As a result of the spill, there was damage to property as well as to the incomes of fishermen, along with the loss of recreational facilities. Mead and Sorensen have tried to estimate these costs.

According to Mead and Sorensen, Union Oil spent about $10.5 million to clean up the beaches and to prevent the further spread of the oil. The value of the oil lost in the process was about $0.13 million. The various official agencies involved spent about $0.64 million in the cleanup process. The authors estimated the damage to property at about $1.2 million. Together, these estimates of direct cost add up to approximately $12.5 million (all values in constant 1969 dollars).

Attempts by Mead and Sorensen to estimate the indirect costs posed many practical difficulties. They found that tourism declined in the city of Santa Barbara, presumably causing some loss of income to the businesses dependent on the tourist trade, and some loss of consumer surplus to the visitors. However, the tourist trade increased at other vacation spots, presumably as a result of changes

in plans by tourists. This shift of the tourist trade meant that the losses for one set of businesses implied gains for another set of businesses; any computation of the loss to California society as a whole should include the gain to businesses at the competing vacation spots.

These changes in the plans of the tourists also imply some loss to the tourists, since they incurred extra travel costs and/or were forced to go to a second-preference tourist spot. Mead and Sorensen did not consider this, perhaps because they felt that this loss would be relatively small.

The businesses affected by the decline in tourist trade sought compensation from Union Oil. Claims were filed under the doctrines of Negligence and Nuisance. In a major case arising from the spill, *Union Oil v. Oppen* [501 F.2d 570 (9th Cir. 1974)], the plaintiff's petition was denied. The court held that only those injured parties whose livelihood depended on the direct use of the sea would have legitimate claims.

Commercial fishermen were also affected by the oil spill. The fishermen sued Union Oil for compensation under the doctrines of Negligence and Nuisance. As explained in the preceding section, under the doctrines of Negligence, the fishermen would have to prove that the defendant was negligent, that the defendant's actions were the cause of the plaintiff's losses, and that the defendant could have foreseen this.

The defendant's negligence was not difficult to establish when the oil was spilling at such a high rate. However, when the rate of oil spilled decreased, it became more difficult to show that this small spill led to reduced fisheries catches. The difficulty was in proving it was the oil, and not a multitude of other plausible factors, which led to the reduction of oyster and fish landings [see *Douat v. Texas Co.*, 205 La. 313, 17 So. 2d 340 (1944)].

The court accepted the plaintiff's argument that the defendant could have foreseen the effects of his actions:

> To assert that the defendants were unable to foresee that negligent conduct resulting in a substantial oil spill could diminish aquatic life and thus injure the plaintiffs is to suppose a degree of general ignorance of the effects of oil pollution not in accord with good sense. (*Id.* at 569)

Note that while the compensation of the commercial fishermen was decided on the grounds of negligence, the court argued that the defendant's actions could also be construed as a public nuisance under California law because the monetary loss was of a "particular and special nature" (*Id.* at 570). The fishermen received $880,000 as compensation in 1977.

Sorensen (1976a,b) also considered another type of indirect cost: damage to the environment. Sorensen proposed replacement cost as the appropriate method for estimating the short-term environmental damage. As explained earlier, this method uses the prices charged by biological supply houses to evaluate the loss of aquatic life or wildlife. The weakness of this method has already been discussed. In the actual event, the State of California's suit was settled out of court without any attribution of payments to particular claims.

Mead and Sorensen (1970) attempted to estimate the value of the recreational facilities lost by the residents, using the direct survey approach of the willingness-to-pay method. They telephoned a random group of 500 residents to find out the willingness to pay of the average resident.

The residents were asked to compare their relative enjoyment of a trip to the beach with a trip to a movie theater to see an "average" movie. This method resulted in a recreational value loss of $3.15 million.

As we have pointed out, the direct survey approach is one way of measuring the people's willingness to pay for recreational facilities. The ad hoc nature of this approach is obvious from the study above. For present purposes, it is sufficient to say that there would be no theoretical justification for using the figure of $3.15 million as an estimate for either the compensated variation, the loss of consumer surplus, or the total willingness to pay for recreational facilities.

One group of residents tried to claim compensation for the loss of recreational facilities. In *Oppen v. Aetna Insurance Co.* [485 F.2d (9th Cir. 1974)], private owners of pleasure boats made a claim for the loss of navigation rights in the habor and channel at Santa Barbara. The plaintiffs used the doctrine of Public Nuisance to support their claim. However, the court ruled that loss of navigation rights was suffered by the public in general, and that the plaintiffs

were not affected differently from the general public (*Id.* at 260). Consequently, the plaintiff's claim was denied. Note, however, that the court granted that actual physical damages to the boats were recoverable by the owners.

The Zoe Colocotroni *Spill*

The *Zoe Colocotroni* spill brought forth further novel legal issues, with an explicit consideration by the courts of the economic methods to be used for calculating indirect costs.

Description of the Zoe Colocotroni *Spill.* The *Zoe Colocotroni*, on route from Venezuela to Puerto Rico, grounded on a reef on March 18, 1973, just 3 miles off the southern coast of Puerto Rico. The tankship was carrying 187,670 barrels of crude oil at the time of grounding. In an attempt to free the ship from the reef, the captain ordered some of the cargo dumped into the sea. The release totaled about 50,000 barrels of crude oil and resulted in an oil slick about 4 miles long and 0.1 miles wide.

The oil slick washed onto the beaches and into a 4-mile-long mangrove forest which fronts the Bahia de Sucia in southwestern Puerto Rico. The oil penetrated to a depth of 14 in. into the sediments of the forests, damaging the roots of the mangroves, thereby affecting an important "intertidal habitat for crustaceans such as barnacles and crabs, as well as snails, bees and reptiles" (*National Wetlands Newsletter*, March–April 1981, p. 12).

Analysis of the Zoe Colocotroni *Spill.* The U.S. government, the government of Puerto Rico, and a large group of fishermen filed claims for damages. The claim of the Puerto Rico government raised some critical legal questions. This discussion will be confined to that claim, since the other claims essentially repeated the major issues involved.

The Puerto Rican government's claim totaled $14.7 million and covered the following costs: (1) the direct costs of cleanup and control ($0.78 million); (2) the direct costs of removing dead and dying mangrove trees, and removing and replacing all soiled sediments ($7.17 million); (3) the direct costs of replanting 23 acres from which dead and dying mangrove trees had been removed ($0.56

million); (4) the direct costs of environmental damages, calculated by the replacement cost method, for marine animals killed ($5.5 million); and (5) the direct costs of environmental damages, calculated from the costs of a long-run scientific research project to study and mitigate future damages ($1.39 million).[11] Note that the Puerto Rican government had to claim current as well as future costs at the same time because of the legal principle of "one bite at the cherry"—only one suit can be brought for damages.

The first task of the Puerto Rican government was to show that it had standing. There was no doubt that the Puerto Rican government owned the swampland harmed by the oil; for that reason, like any other landowner, the government could bring an action under the Law of Admiralty.[12] However, the Commonwealth of Puerto Rico also sought damages on behalf of its people "for loss of living natural resources such as trees and animals" in *Puerto Rico v. S.S. Zoe Colocotroni* [628 F2d 652, 670–71 (1st Cir. 1980)].

The plaintiff claimed that the Commonwealth of Puerto Rico was a "public trustee" of the damaged resources, while the defendant argued that Puerto Rico did not have this status. The district court ruled that under an existing statute [P.R. Laws Ann. Lit. 12 Sec. 1131 (29) (1977)], the Commonwealth did have a proper "cause of action" in Statute Law (i.e., law written by the legislature), and thus the plaintiff did not need to resolve the issue of whether or not the Commonwealth had a right under the common law to recover for things it did not own; the court simply avoided the issue.

The district court ruled that Puerto Rico could bring suit because it (1) had a "proprietary interest" in the harmed natural resources, (2) was the "trustee of the public trust" of these resources, and (3) was *parens patriae*. These concepts were discussed earlier.

This dispute about Puerto Rico's right to sue related only to its claim for environmental damage. There was no such dispute about Puerto Rico's claim for direct costs. However, the district court did not grant the claim of $7.2 million for removing injured mangrove trees and oiled sediments, on the grounds that this plan would result in considerable damage to the environment, without any guarantee of ultimate success. The other two claims for direct costs were granted.

Once Puerto Rico's standing had been established, there still remained the question of the amount of compensation for the environmental damage. The fact that the wildlife did not have any commercial value was a major source of controversy in the case. The arguments involved are too complex to be discussed in full here, but essentially, the conclusion was that although the aquatic life and/or vegetation may not have had commercial value, it did have ecological value because the organisms that had been destroyed were vital links in the aquatic food chain.

On the basis of the foregoing logic, the court concluded that the destruction of trees and animals did have a detrimental impact on Puerto Rico's natural environment, with consequent injury to the people of Puerto Rico.

In determining the compensation, the district court accepted the replacecost method, and granted Puerto Rico the $5.5 million it had claimed. This decision of the district court was appealed by the defendants to the U.S. First Circuit Court of Appeals. The defendants claimed that the "plaintiffs were entitled only to the difference in the value of the property before and after the spill—that is, the value of the property had diminished because of the damage inflicted to it by the oil" (Jimenez, 1982, p. 223).

The appeals court did not accept the defendant's argument. Instead, the court argued that the concept of restoring or rehabilitating the environment was implicit in much of the relevant federal legislation enacted in the 1970s. Nevertheless, the appeals court rejected the replacement cost method used by the district court to estimate the damage to the environment. The principal reason for this rejection was that, as a practical matter, Puerto Rico had no intention of replacing the organisms (see Brown, 1982, p. 201). The appeals court did not try to estimate the damages itself. Instead, it remanded the case, asking the trial court to use a more suitable method to estimate these damages (Jimenez, 1982, p. 236).

Summary

This paper has presented an overview of legal and economic theories currently used to assess liability and damages for accidental oil spills. After a discussion of the theoretical concepts, two case

studies were presented. The methods that had been used to assess liability and damages in these cases were critically assessed.

The relevant theories used to estimate the nonmarket-valued economic loss due to oil pollution were presented. Although several different theoretical methods have been used in economics to calculate the benefits of nonmarket goods and therefore the monetary value of the loss of these goods, the usefulness of each of these methods is unfortunately limited by data requirements and some degree of empirical bias.

The legal principles used to assess damage claims for compensation in oil spill cases where damage has occurred to commercial and/or noncommercial animal life, and to replaceable as well as irreplaceable resources, were discussed. It was shown that the law used in accidental oil spill cases is complex, and in some cases, ambiguous in theory and in practice. This was evidenced in the cases related to the Santa Barbara spill and the *Zoe Colocotroni* spill.

As should be clear from our discussion, the existing state of the arts concerning accidental oil spills in economics and law is far from satisfactory: a multitude of often competing and confusing approaches exist in both law and economics. What is required is a unifying thread which draws the disparate bodies of analysis into a coherent whole. This, we believe, should be the emphasis of future research.

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Notes

1. Estimating losses can sometimes be difficult even when market prices are known. For instance, estimating the loss of income to commercial fisheries arising from accidental oil spills is extremely difficult (despite the

known market value of the catch) because the quantity of catch lost is not known with certainty.

2. See Bishop and Heberlein (1979).

3. See Brown (1982).

4. The degree of bias depends on (1) the relative magnitudes of the substitution and income effects of a price change, (2) the importance of the commodity in the consumer's budget, and (3) the income elasticity of demand. For a more detailed discussion of this, see Griffin and Steele (1980, pp. 46–49). For a discussion of how to measure the bias, see Willig (1976, pp. 589–597) and Henderson and Quandt (1980, pp. 25–31).

5. Although the possible strategic bias is the major problem associated with the direct survey approach, there are several other biases that may arise. See, for instance, Randall (1981).

6. For an excellent empirical analysis using the travel cost approach, see Smith et al. (1983). The model they use is an extension of the varying parameter model presented by Vaughan and Russell (1982), but allows for site-specific benefits of improved water quality, instead of national (or average) willingness to pay across all sites. As suggested by Smith et al., a site-specific evaluation is preferred.

7. For this review, we have drawn heavily on Walmsley (1975) and Gordon (1980–1981).

8. See *Environ. Law Rep.* 7: 20658–20661; 9: 20237–20242; 10: 20278.

9. See "State protection of its economy and environment, *parens patriae* suits for damages," *Columbia J. Law Social Prob.* 6: 411 (1970).

10. See 43 U.S.C. 1331 et seq., and also, Krueger and Singer (1979) have codified earlier tendencies and established new developments.

11. See Jimenez (1982, pp. 230–232).

12. See Restatement (Second) of Torts, Sec. 871 (international harm to property).

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