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# Negative Externalities and Oil Spills: A Case for Reduced Brand Value to the State of Florida

**Sherry L. Larkin, Ray G. Huffaker, and Rodney L. Clouser**

Despite recent advances in measuring and compensating for environmental damages, several challenges remain. States have a vested interest in claiming economic damages, especially those that reduce the value of investments. Because place-brand values are considered personal property, Florida may seek additional compensation from the *Deepwater Horizon* oil spill.

**Key Words:** branding, nonmarket valuation, Oil Spill Pollution Act, reputation

**JEL Classifications:** K32, Q51

Offshore oil drilling is necessarily associated with a certain amount of risk, especially as technological advances have allowed for operations in deeper waters. As a result of past spills, there is a strong and growing body of literature on how to measure environmental damages and corresponding economic losses. Concurrently, regulations and legal precedents have established procedures for addressing compensation and mitigation of damages associated with oil spills. Despite the progress in accounting for the potential negative externalities associated with drilling for oil, several challenges remain when considering how to measure and

compensate affected entities for damages. The challenges are magnified when damages are difficult to quantify (e.g., when long-run environmental impacts are unknown, tourism is lost as a result of perceptions of an oiled coast or residential home values decline as a result of the stigma of an oiled coast). Whereas economic theory and historical precedent would suggest waiting until damages can be measured, the legal system is time-limited. In addition, although some economic damages may be localized such that measures of social welfare changes at the national level would be negligible, individual states often serve as trustees for their residents and have the right and motivation to sue for compensation on their behalf.

This article aims to address economic damages from oil spills by considering the measurement of “pure economic losses,” which are defined as economic losses in the absence of physical injury to property (i.e., indirect effects or externalities such as oil spills that damage a reputation and result in coastal restaurants unable to sell local seafood). These losses are analogous to nonmarket losses associated with existence values, whose valuation issues have been summarized in relation to oil spills

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beginning with, for example, articles by Assaf, Kroetch, and Mathur (1986) and Grigalunas et al. (1986). There is a complex legal system regarding compensation for pure economic losses that recognizes the different entities (individuals; businesses; and state, federal, and tribal governments), distinct types of losses that can be claimed by each, and bars double compensation. The Oil Pollution Act of 1990 (OPA) was passed shortly after the *Exxon-Valdez* oil spill in 1989 and was intended, in part, to help clarify the legal framework by providing guidance as to the types of losses due recovery, but considerable uncertainty remains.

To address the issue of compensable economic losses from pure economic losses resulting from trustees as a result of oil spills in the United States, this article first presents a brief summary of the legal framework for economic loss compensation resulting from oil spills. Then, the 2010 *Deepwater Horizon* oil spill that occurred in the Gulf of Mexico is described. Subsequent to this background, the value of place-brands (i.e., reputation) is presented and adapted to the context of damages from oil spills. We conclude with a discussion of how alternative valuation methods can be used by a state agency to potentially recover these losses and a summary of key points to be considered in the future.

## Legal Background

The legal framework for investigating and estimating compensation for economic losses resulting from a spill is extremely complex as a result of a plethora of agencies and legal "Acts." That said, there are two primary federal laws (statutes) that directly address environmental contamination from oil: 1) the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA/Superfund); and (2) the OPA of 1990.<sup>1</sup> These statutes assign

liability for both removing the oil and determining the injury to natural resources (e.g., groundwater, soil, fish, plants, birds, other wildlife, and their habitats).

For example, under CERCLA, governments can seek compensation for compensatory and punitive damages (those meant to reimburse and deter future incidents, respectively) associated with "lost beach value" (Bell, 2002, p. 60). Government plaintiffs sue on behalf of the public; this is because "federal courts have consistently held that private natural resource claims are to be brought by statutory trustees, not private citizens" (Quimby, 2011, p. 103). Public damages are typically comprised of two types of losses: 1) forgone sales tax revenue from in-state businesses; and (2) non-market losses incurred by residents. Forgone sales tax revenues can be calculated with a time-series analysis of sales by industry and collected damages could be redirected to help those industries. Nonmarket losses include lost use and nonuse values such as impacted recreational trips and impacted *in situ* resources, respectively. Determining interim losses (i.e., those incurred between the date of the accident and time of "full restoration") in both use and nonuse value to the public requires the use of nonmarket valuation techniques with the estimated losses going to the state, which will "...spend the equivalent on enhanced resource services to the affected public (e.g., additional protected wildlife habitat that will benefit those who fish, hunt, observe, or otherwise value wildlife)" (Stewart, 2010, p. 7).

The OPA stipulates that restoration costs and the diminished value of affected natural resources (use and nonuse) can be recovered from guilty parties. The legal definition of "covered removal costs and damages" under the OPA is presented in Figure 1. Thus, the OPA is directly applicable to assessing lost public uses associated with oil spills; however, losses under the OPA are capped at \$75 million (in addition to removal costs). If the deemed "responsible party" is found to be grossly negligent, then violations of the Clean Water Act (such as from discharging oil into U.S. waters) allow for penalties of up to \$4300 per barrel (i.e., \$21.5 billion based on the

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<sup>1</sup> The current system of oil spill response is described in terms of the primary federal acts; however, the legal framework also includes elements of Superfund Amendments and Reauthorization Act of 1986 and the Emergency Planning and Community Right-to-Know Act (Mills et al. 2011).

**33 U.S.C. § 2702. Elements of liability**

(a) In general . . .

(b) Covered removal costs and damages

(1) Removal costs . . .

(2) Damages

The damages referred to in subsection (a) of this section are the following:

(A) Natural resources

Damages for injury to, destruction of, loss of, or loss of use of, natural resources, including the reasonable costs of assessing the damage, which shall be recoverable by a United States trustee, a State trustee, an Indian tribe trustee, or a foreign trustee.

(B) Real or personal property

Damages for injury to, or economic losses resulting from destruction of, real or personal property, which shall be recoverable by a claimant who owns or leases that property.

(C) Subsistence use

Damages for loss of subsistence use of natural resources, which shall be recoverable by any claimant who so uses natural resources which have been injured, destroyed, or lost, without regard to the ownership or management of the resources.

(D) Revenues

Damages equal to the net loss of taxes, royalties, rents, fees, or net profit shares due to the injury, destruction, or loss of real property, personal property, or natural resources, which shall be recoverable by the Government of the United States, a State, or a political subdivision thereof.

(E) Profits and earning capacity

Damages equal to the loss of profits or impairment of earning capacity due to the injury, destruction, or loss of real property, personal property, or natural resources, which shall be recoverable by any claimant.

(F) Public services

Damages for net costs of providing increased or additional public services during or after removal activities, including protection from fire, safety, or health hazards, caused by a discharge of oil, which shall be recoverable by a State, or a political subdivision of a State.

**Figure 1.** Summary of the Provisions on Compensable Claims for Removal and Damages under the Oil Spill Pollution Act (33 U.S.C. § 2702. Elements of Liability)

five million barrels spilled by the *Deepwater Horizon*).

Under CERCLA, associated amendments to the Superfund, and OPA, the federal government has established guidelines for using surrogate and nonmarket methods (travel cost and contingent valuation, respectively) for value changes to the quality of natural resources in liability cases. Both methodologies have legal standing such that they may be used to calculate “compensable values” for lost public uses and the use of these methodologies may not be challenged in court (although how they were applied can be challenged).

In addition to federal laws, individual states can enact their own legislation to claim compensation for damages to natural resources, including collateral damages (i.e., externalities). For example, Florida passed The Florida Pollutant Discharge Prevention and Control Act

(Olexa and Broome, 2005), which was recently used by a private party to sue for lost profits from damage to a reputation; in particular, commercial fishermen claimed that their reputation was a form of “real or personal property” and the courts agreed (Curd v. Mosaic Fertilizer). In short, although the fishermen did not own the resources, they did own and invest in a reputation and both were forms of property that could be damaged and due recovery.

In summary, the State of Florida could have standing under the OPA with respect to pure economic losses from a diminished place-brand value under subsections B and E. Past litigation has been more successful in recovering pure economic losses through E based on a different (broader) interpretation of “property,” primarily that Congress intended E to be more broad because otherwise it would be redundant

to B. The upshot? “Congress intended to allow a claimant who does not own any damaged property to recover for purely economic losses stemming from an injury to natural resources” (Quimby, 2011, p. 93). Furthermore, there is international precedent of such claims; a 1978 oil spill in France resulted in compensation for the “incremental promotional activities to prevent any erosion of France’s ‘product image’ in this [oyster and shellfish] market” (Grigalunas et al., 1986, p. 246). In addition,

From a national perspective, “product image” is an intangible capital asset, which provides real income for France. Erosion of this asset resulting from the oil spill represents a loss in real income to France. However, higher-than-normal promotional costs may not be a social cost to the world because rival countries could occupy the market niche formerly filled by French firms (p. 258).

This last phrase highlights the importance of externalities in evaluating impacts from oil spills at the state level. Although some “costs” or “lost revenues” may have been redistributed to other states, reducing the national-level impact, the losses are valid to the impacted state and claims of unjustified excessive expenditures to reverse the redistribution of tourism expenses are warranted to maintain market share.

### **Deepwater Horizon Oil Spill**

On April 20, 2010, an offshore oil drilling platform, *Deepwater Horizon* (DWH), exploded. The oil rig was being leased by BP (formerly British Petroleum), which has been officially designated as the “responsible party.” From April 20, 2010, to July 15, 2010 (87 days), the damaged well released nearly five million barrels (approximately 205 million gallons) of oil into the Gulf of Mexico. The DWH was deemed a “Spill of National Significance” on April 29, 2010, and it is the largest accidental marine oil spill in history. The Ixtoc oil spill, the second largest, was also in the Gulf of Mexico. The Ixtoc released 140 million gallons in 1979–1980 over ten months in the southeastern part of the gulf and, as a result of the relatively slow release, does not appear to have caused lasting negative impacts on the

ecosystem (although no comprehensive studies were conducted to confirm recovery). For comparison, the *Exxon-Valdez* oil spill in Alaska released 11 million gallons in a remote bay in 1989. By contrast, the DWH was a subsurface-level spill, where the oil leaked from the seabed approximately one mile below sea level and 40 miles from the Louisiana coast. The location of the spill, extent of oil coverage, and closures of federal fishing areas are shown in Figure 2.

### **Place-Brand Valuation**

Regions invest advertising dollars to develop and proactively manage “place-brands” that convey distinct reputations for providing various types of regional services, for example, high-quality tourist visits (Baker, 2010; Tan, 2011; The Burghard Group, 2010). In economic terms, place-brands can be interpreted as capital assets that generate an income stream by stimulating demand for regional services.

In general, asset value is computed as the present value,  $PV$  (\$), of the income stream,  $R_t$  (\$/t), accruing to the asset owner from a given initial time  $t = t_0$  into perpetuity:

$$(1) \quad PV = \sum_{\tau=t_0}^{\infty} \delta^{\tau} R_{\tau},$$

where  $\delta^{\tau} = 1/(1 + r)$  is a discrete (geometric) discount factor and  $r$  is the financial discount rate representing the opportunity cost rate of return on a comparable investment. As such, both  $r$  and  $\delta^{\tau}$  fall between zero and one. If the asset generates a constant annuity,  $R$  (\$/year), into perpetuity, the asset valuation formula converges to  $R/(1 - \delta)$ , or more generally:

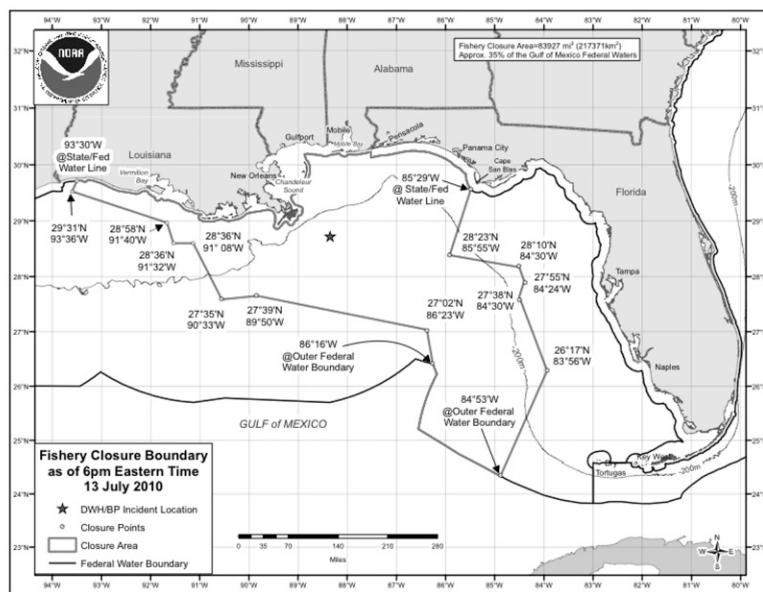
$$(2) \quad PV = R \sum_{\tau=t_0}^{\infty} \delta^{\tau} = \frac{R}{1 - \delta} \delta^{t_0}$$

In this application the annual annuity would be the value of the place-brand (associated with a high-quality marine environment from sustainable *in situ* resources) less the annual advertising and investment expenditures incurred by the State of Florida to maintain the place-brand value. For example, the purpose of Florida’s place-brand could be limited to

## Location of DWH



## Extent of Largest Fishing Closures in Federal Waters



**Figure 2.** Maps Showing the Location of the *Deepwater Horizon* Oil Spill, Oil Coverage, and Fisheries Closures

generating a flow of income from residents and nonresidents that spend money in the state. Florida's place-brand value could also include the nonmarket values associated with the existence of *in situ* resources, which, in economic

terms, can be measured as residents' willingness to pay (WTP) for the reputation.

Consider the impact of an event occurring at time  $t$  that eliminates the value of the asset into the future. In this case, the asset value ( $R$ )

is only earned over a finite time horizon that begins at time period zero:

$$(3) \quad PV = R \sum_{\tau=0}^t \delta^\tau = \underbrace{\frac{R}{1-\delta}}_{\text{infinite time horizon}} - \underbrace{\frac{R}{1-\delta} \delta^t}_{\text{net out } PV \text{ not accruing after } t}$$

$$= \frac{R(1-\delta^t)}{1-\delta}$$

Using the asset value formulae represented in equations (2) and (3), the asset value for an infinite time horizon beginning at  $t$  (where  $t > 0$ ) is derived as follows:

$$(4) \quad PV = R \sum_{\tau=t}^{\infty} \delta^\tau = R \sum_{\tau=0}^{\infty} \delta^\tau - \underbrace{R \sum_{\tau=0}^t \delta^\tau}_{\text{net out period during which } R \text{ does not accrue}}$$

$$= \underbrace{\frac{R}{1-\delta}}_{R \sum_{\tau=0}^{\infty} \delta^\tau} - \underbrace{\frac{R(1-\delta^t)}{1-\delta}}_{R \sum_{\tau=0}^t \delta^\tau} = \frac{R}{1-\delta} \delta^t$$

This equation is needed to consider the effects of a lower asset value (as opposed to eliminated value) following the event at  $t > 0$ .

In this application, consider the case in which the State of Florida experiences "interim losses" in place-brand value. This is accomplished, in part, by deriving an asset value formula for an interim time interval. The interim time interval reflects the period between when the oil spill occurred,  $t_1$ , and when "full restoration" is achieved,  $t_2$  (assuming  $t_0 < t_1 < t_2$ ). Using equations (2), (3), and (4), the asset value between two time periods,  $t_1$  and  $t_2$ , is derived by subtracting the asset value before the spill and after the spill from the asset value over an infinite time horizon:

$$(5) \quad PV = R \sum_{\tau=t_1}^{t_2} \delta^\tau$$

$$= R \sum_{\tau=0}^{\infty} \delta^\tau - \underbrace{R \sum_{\tau=0}^{t_1} \delta^\tau}_{\text{net out intervals during which } R \text{ does not accrue}} - \underbrace{R \sum_{\tau=t_2}^{\infty} \delta^\tau}_{\text{net out intervals during which } R \text{ does not accrue}}$$

$$= \underbrace{\frac{R}{1-\delta}}_{R \sum_{\tau=0}^{\infty} \delta^\tau} - \underbrace{\frac{R(1-\delta^{t_1})}{1-\delta}}_{R \sum_{\tau=0}^{t_1} \delta^\tau} - \underbrace{\frac{R}{1-\delta} \delta^{t_2}}_{R \sum_{\tau=t_2}^{\infty} \delta^\tau}$$

$$= \frac{R}{1-\delta} (\delta^{t_1} - \delta^{t_2})$$

This asset value that is generated during the interim time interval is presumably lower and can be used to estimate residents' WTP for the reputation, in this case for "full restoration" of the *in situ* marine resources; as such, stated preference valuation methodologies are relevant for estimating brand valuation (Voegele and Sedimayr, 2007). The most typical use of stated preference methods to estimate WTP is for measuring the lost nonuse (passive use) values. This is because the other types of public damages can be estimated using revealed preference methods that use data on past behavior and thus are perceived to be more credible. Researchers that are charged with estimating lost passive use values thereby attempt to ensure that all use values are accounted for to prevent double counting (i.e., lost use values would be estimated separately using revealed preference methods such as single- and multi-site travel cost). Because researchers attempting to measure lost passive use values will do so for "users" and "nonusers" (e.g., Carson et al., 2004; Loureiro et al., 2009), the question remains as to whether the additional WTP of users (which is presumably higher than that of nonusers because it incorporates additional values) can be reasonably considered to reflect reduced reputation (value of the brand). Such a measure would capture, for example, the additional value that a recreational user is willing to pay for "full restoration" of the resources.

Assuming the oil spill impairs the value of Florida's place-brand asset by damaging the region's reputation for high-quality natural marine-based resources, the difference between user and nonuser WTP represents the lost place-brand value during the period of recovery. To model this, we assume the place-brand generates a constant annuity  $R_1$  before the oil spill ( $t_0 < t < t_1$ ), a reduced annuity  $R_2 < R_1$  during the interval when place-brand driving income declines as a result of the oil spill ( $t_1 < t < t_2$ ), and the preoil-spill annuity  $R_1$  after recovery ( $t_2 < t < \infty$ ).

Under this scenario, the asset value of the place-brand over an infinite time horizon given an altered flow of revenues between two time periods,  $t_1$  and  $t_2$ , is calculated by summing the asset values that are generated during the three

distinct time periods: i.e., before the spill, during restoration, and after full restoration (equations [3], [5], and [4], respectively):

$$\begin{aligned}
 PV &= R_1 \sum_{\tau=t_0}^{t_1} \delta^\tau + R_2 \sum_{\tau=t_1}^{t_2} \delta^\tau + R_1 \sum_{\tau=t_2}^{\infty} \delta^\tau \\
 &= \frac{R_1}{1-\delta} (\delta^{t_0} - \delta^{t_1}) + \frac{R_2}{1-\delta} (\delta^{t_1} - \delta^{t_2}) \\
 &\quad + \frac{R_1}{1-\delta} \delta^{t_2} \\
 (6) \quad &= \frac{R_1}{1-\delta} \delta^{t_0} - \left[ (R_1 - R_2) \left( \frac{\delta^{t_1} - \delta^{t_2}}{1-\delta} \right) \right].
 \end{aligned}$$

The first term on the right side calculates the place-brand's value over an infinite time horizon if the oil spill had not occurred (i.e., equation [2]). The second term on the right side measures lost interim asset value resulting from the oil spill (i.e., the difference in asset value given a shift from  $R_1$  to  $R_2$  during time interval  $t_1 < t < t_2$ ) and, consequently, the damages that the responsible party owes the state ( $D$ ).

The effects of each parameter (i.e.,  $r$ ,  $t_i$ , and  $R_i$  where  $i = 1$  or  $2$ ) on the value of damages (i.e., lost interim asset value) can be analyzed using the marginal values. For this application, the policy-relevant parameters to consider are the estimated difference in place-brand annuities before and after the spill ( $R_1 - R_2$ ) and the time to full restoration ( $t_2$ ). Using the damages ( $D$ ), the marginal impact of an incremental increase in the difference between the prespill periodic income and reduced income after the spill is:

$$\frac{\partial D}{\partial (R_1 - R_2)} = \left( \frac{\delta^{t_1} - \delta^{t_2}}{1-\delta} \right) > 0$$

(7) since  $\delta < 1$  and  $t_1 < t_2$ ,

and the marginal impact of an incremental increase in the final time period of restoration in which income is reduced is (Appendix):

$$\frac{\partial D}{\partial t_2} = \left( \frac{R_1 - R_2}{1-\delta} \right) \delta^{t_2} \ln \delta > 0$$

(8) since  $R_1 - R_2 > 0$ .

Analysis of these marginal measures demonstrates that the responsible party could reduce damages with actions that decrease the gap in periodic income during place-brand impairment ( $R_1 - R_2$ ) and/or shrinks the time interval of

impairment (i.e., by decreasing the final time period,  $t_2$ , during which income is reduced).

### *Recovering for Impaired Place-Brands*

Impairment to Florida's place-brand asset arguably fits best in the OPA damages category specifying the "loss of profits or impairment of earning capacity due to the injury, destruction, or loss of real property, personal property, or natural resources, which shall be recoverable by any claimant." In this case, the claimant would be the State of Florida and the loss would reflect that associated with a reduction in place-brand value linked to a damaged reputation.

A key issue is whether the "reputation" developed and managed by a place-brand qualifies as property in a legal sense. Two comprehensive reviews of reputation law answer in the affirmative (Heymann, 2011; Post, 1986). Viewing reputation as personal property has found favor with both legal commentators and courts because reputation shares essential characteristics with other things considered to be property. In particular, reputation has "economic value, derived from the market, rendering it both the subject of trade, and the basis of compensation resulting from harm." Thus, we conclude that the OPA does give Florida standing to claim damages for lost reputation, as a desirable natural resource-based location, as a result of an oil spill polluting its coastal areas and waters.

A potential drawback of envisioning reputation as property is that "reputation seems particularly difficult to limit with cognizable boundaries...[t]he nature of one's reputation can change from day to day." This would not present a problem for equating Florida's place-brand with property to the extent that Florida could demonstrate that its reputation for desirable beaches was consistently high before the oil spill. Another potential drawback would be if Congress intended for the OPA to take a narrow view of property that would exclude reputation. However, this appears contrary to Congress' intent for the OPA "to provide compensation for a wide range of injuries [that] are not so narrowly focused as to prevent victims of an oil spill from receiving reasonable compensation."

Another issue could be whether recovering damages for impaired place-brand in addition to damages from reduced passive-use values contravenes the OPA's prohibition against "double recovery." However, there is no double recovery because damages for the impaired place-brand asset are based on lost values from users (i.e., those that enjoy recreating in the Gulf), which are distinguishable from compensable lost passive-use (option and existence) values. Because previous studies undertaken have estimated lost passive use values and have incorporated steps to ensure the values do not include use values (Carson et al., 2004; Loureiro et al., 2009), the estimation of this additional value to users is standard and, therefore, easy to obtain. Also, it is that portion of nonuse values that is typically ignored despite reflecting a valid change in value.

A final complication is the "indirect" relationship between the responsible party and the public. When individual states serve as trustees, the state is representing all resident "stakeholders." If successful, the state will receive compensation for compensable damages that will be used to support related conservation efforts; however, the individual stakeholders themselves may be unaware of the state's efforts on their behalf. This type of disconnect can result in lower compensation (settlements) because affected parties are not pressuring the government to improve negotiations (Bell, 2002). In addition, the government may have little incentive to devote resources to continued negotiations or even a jury trial as a result of the additional time and risk. In Florida, a negotiated settlement (as opposed to a trial by jury) between the state and responsible party was 37% below the mean of estimated damages experienced by stakeholders; in contrast, a jury trial is credited for the State of California receiving significantly higher compensation for an in-state spill occurring at about the same time (Bell, 2002).

## **Summary and Discussion**

This article sought to provide a novel aspect of potential compensation for externalities inflicted as a result of oil spills by considering the

loss of reputation. This is accomplished by identifying how current legislation gives the State of Florida legal standing to pursue damages resulting from pure economic losses that result from a loss in real property value, namely a place-brand reputation. Basic capital theory is used to derive a formula for damages and marginal analysis is used to identify two distinct approaches for reducing damages. Although empirical estimates cannot be generated at this time as a result of ongoing litigation, this article is able to identify the arguments, methods, and analyses that economists can conduct in future research.

In particular, the branding issue was explored whereby "place-bland" was considered the result of significant investment by a region (i.e., State of Florida) in maintaining a strong reputation for the quality of its natural resources, for a suite of purposes, over time. Typically, the estimates of lost economic value are restricted to covering a well-defined and relatively short period of time (e.g., one year); however, compensation is allowed for damages of the "loss of profits or impairment of earning capacity . . .," which implies damages over a long time horizon (as opposed to just "interim" losses) are compensable. However, double compensation is not allowed so any damages sought by the State of Florida would need to be distinct from compensation received as a part of the national-level estimates of lost passive use value by National Oceanic and Atmospheric Administration. In this case, the damages would be to "reputation," which has been ruled as personal property because reputation shares essential characteristics with other things considered to be "property." In particular, reputation has "economic value, derived from the market, rendering it both the subject of trade, and the basis of compensation resulting from harm" (Heymann, 2011; Post, 1986). As a result, lost place-brand value is a compensable economic loss under the OPA, and the State of Florida is an allowable claimant.

Furthermore, because the State of Florida has invested significant resources in an attempt to "brand" the state for the benefit of both residents and visitors, attempting to estimate

the change in consumer surplus associated with factors that reflect the effects of branding (as noted by Voegele and Sedimayr, 2007) has merit, especially because marketing campaigns have acknowledged the potential for oil to negatively impact the state's reputation for high-quality coastal areas (Ross, 2010).

On the cost side, Florida invests in its place-brand for coastal regions through *VISIT FLORIDA*®—a public/private advertising partnership that receives substantial financial support from the state. In addition to generic advertising of beach areas, *VISIT FLORIDA*® has helped to brand (with the support of local economies) distinct coastal regions including the Emerald Coast (panhandle), Nature Coast (panhandle to central Gulf), Suncoast (west-central to southwest), Gold Coast (southeast Atlantic), and Treasure Coast (central Atlantic).

An example of a potential compensation mechanism would be for BP to invest in advertising required to restore Florida's place-brand reputation as quickly as possible (i.e., a reduction in  $t_2$  from the marginal analysis). BP, in fact, is doing some of this. In 2010, a \$25 million BP payment was allocated between *VISIT FLORIDA*® (\$7.2 million) for a 3-week advertising campaign and eight Florida counties affected by the oil spill (\$4.4 million) for various activities. The remaining \$13.4 million of the BP payment was reserved for future advertising (Ross, 2010). *VISIT FLORIDA*® also initiated another campaign called "Florida Live" in which pictures and videos were uploaded on the web to show potential visitors that the actual state of Florida beaches was better than reported by the media (Rooney, 2011); this would be an example of attempting to reduce the lost place-brand value during restoration (i.e., reduce  $R_1 - R_2$  from the marginal analysis). In fact, both of these strategies have been pursued by various corporate entities in the face of crisis to various degrees of success. Notable examples include the 1982 recall of \$100 million in Extra Strength Tylenol nationwide in response to tampered product in one market, which is an example of a focus on reducing the time to full restoration (and was successful) as compared with Penn State's continued support of Jerry Sandusky in an effort

to reduce the loss in brand equity (and was largely considered unsuccessful) (Olenski, 2012).

To date, all U.S. claims for pure economic losses have been settled based on relatively simple analysis (being both reliable and valid for the application). Broader interpretations of the OPA and/or the passage of state-level acts that allow for compensation of indirect economic damages (negative externalities) resulting from oil spills will complicate use of economic analyses.

Although techniques for estimating non-market values and nonuse values in particular are accepted by the courts, challenges remain in the appropriate use of estimated values for claims by the state on behalf of the public. For example, stated preference techniques are used for estimating passive-use values but are only used after values by users are removed; in other words, the additional passive-use value experienced (lost) by users—that reflects the brand value—is typically ignored. Although the need to avoid double counting is standard, the need to ensure full compensation should make certain that the impacts on reputation (brand) values are included.

There is little guidance to government agencies that serve as trustees to the public on approaches to achieve full compensation associated with restoration after an oil spill. All papers readily available that address the potential additional compensation are targeted to individuals and businesses (Goldberg, 2010; Palmer, 2011; Quimby, 2011; Stewart, 2010), which is surprising given that some of the categories of claims under the OPA specifically refer to "any claimants." One difference may be that the number of potential trustees for the public is limited and some public agencies are able to retrieve some losses through an income tax, which is not the case in Florida.

In closing, the resolution of claims in the *Exxon-Valdez* case is generally considered to have been extremely complicated and time-consuming but only involved two governments (State of Alaska and federal government) and one defendant (Exxon). By contrast, the DWH case involves at least five states (and possibly individual counties), substantially more oil released (at least 19 times), and the spill was

subsurface (complicating measurement of distribution and impacts). Although a unified approach to settlement of economic damages proposed in this article would be the most efficient, it is unlikely as a result of the diversity of impacts across the Gulf (and within states) and distinct preferences of each entity regarding the capture of losses on behalf of the public.

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**Appendix: Impact of Marginal Change in  $t_2$  on Damages**

Solve for  $\frac{\partial D(t_2)}{\partial t_2}$ :

Rearrange  $D$ :

$$D(t_2) - a\delta^{t_1} = -a\delta^{t_2} \quad \text{where } a = \frac{R_1 - R_2}{1 - \delta}$$

$$\Rightarrow \frac{D(t_2)}{a} - \delta^{t_1} = -\delta^{t_2}$$

Take log of both sides:

$$\ln\left(\frac{D(t_2)}{a} - \delta^{t_1}\right) = -t_2 \ln \delta$$

Implicitly differentiate with respect to  $t_2$ :

$$\Rightarrow \frac{\partial D(t_2)}{\partial t_2} = -(D - a\delta^{t_1}) \ln \delta$$

$$\Rightarrow \frac{\partial D(t_2)}{\partial t_2} = -\left[\underbrace{a(\delta^{t_1} - \delta^{t_2})}_{D} - a\delta^{t_1}\right] \ln \delta$$

$$\Rightarrow \frac{\partial D(t_2)}{\partial t_2} = -[a(\delta^{t_1} - \delta^{t_2}) - a\delta^{t_1}] \ln \delta$$

$$\Rightarrow \frac{\partial D(t_2)}{\partial t_2} = a\delta^{t_2} \ln \delta = \underbrace{\left(\frac{R_1 - R_2}{1 - \delta}\right)}_a \delta^{t_2} \ln \delta > 0$$

since  $R_1 - R_2 > 0$

$$\left(\frac{1}{\frac{D(t_2)}{a} - \delta^{t_1}}\right) \frac{\partial\left(\frac{D(t_2)}{a} - \delta^{t_1}\right)}{\partial t_2} = -\ln \delta$$

$$\Rightarrow \frac{1}{a} \frac{\partial D(t_2)}{\partial t_2} = -\left(\frac{D(t_2)}{a} - \delta^{t_1}\right) \ln \delta$$