

UNITED STATES DISTRICT COURT  
EASTERN DISTRICT OF LOUISIANA

In re: Oil Spill by the Oil Rig  
"Deepwater Horizon" in the Gulf of  
Mexico, on April 20, 2010

\* MDL No. 2179

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\* SECTION: J

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Applies to: *U.S. v. BP Exploration & Prod. Co.*,  
No. 2:10-cv-04536.

\* JUDGE BARBIER

\* MAGISTRATE JUDGE SHUSHAN

\* \* \* \* \*

**Report of  
Professor David L. Sunding**

**Prepared on behalf of Anadarko Petroleum Corporation**

**August 15, 2014**

**TREX-280010.0001**

**REDACTED**

**TREX-280010-R.000001**

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COMPENSATION

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## QUALIFICATIONS

I am the Thomas J. Graff Professor of Natural Resource Economics at UC Berkeley, where I have been a professor in the Department of Agricultural & Resource Economics since 2002. I am the founding director of the Berkeley Water Center, and currently serve as the chair of my department. I teach graduate and undergraduate courses in environmental and resource economics, policy analysis, water resource economics, and law and economics.

My research areas include environmental and resource economics, water resources, land use, regulation, and law and economics. I have won many research awards, including grants from the National Science Foundation, the Environmental Protection Agency, and private foundations.

I have conducted research on the economics of the Clean Water Act, and have analyzed the economic impacts of various regulatory programs carried out under the CWA. I was appointed by the EPA to serve as a member of its Science Advisory Board panel on CWA civil penalties. The SAB was tasked with assessing the reasonableness of the Government's efforts to use "illegal competitive advantage" as a basis for assessing civil penalties under the CWA. (Our panel concluded that such efforts were not justified as a matter of economic theory.) I also served on a panel on water resources convened by the National Academy of Sciences, and as a senior economist at President Clinton's Council of Economic Advisors.

I have published extensively in the areas of environmental and resource economics, law and economics, and the economics of regulation. My work on the economic consequences of changes to the CWA Section 404 regulatory program was cited prominently by the U.S. Supreme Court in its decision in the *Rapanos* case. Recently, I have assessed the incentive effects of the EPA's use of its claimed *ex post* veto authority over §404 permits in the *Arch Coal* case. I testified before Congress on the results of that research.

I advise governments on the design and evaluation of environmental and natural resource policies. For example, I am currently the chief economic adviser to the State of California in its development of the Bay Delta Conservation Plan, a \$25 billion effort to restore the Sacramento-San Joaquin Delta Estuary. I have testified before Congress on numerous occasions on subjects including the economics of Clean Water Act regulatory and enforcement programs, the economics of water quality and water resource allocation, and the effects of environmental protection on capital investment.

I have extensive experience testifying in litigation about the areas of environmental economics, natural resource economics and water resources. I am currently serving as an expert witness for the U.S. Department of Justice in the Klamath Basin litigation, and prepared expert testimony for DOJ in the *Casitas* and *Stockton East* cases. I have been retained as an expert in three water resource disputes of original jurisdiction between states before the U.S. Supreme Court: *Kansas v. Nebraska*; *Texas v. New Mexico*; and *Florida v. Georgia*.

I am a member of the American Economic Association, the American Law and Economics Association, the Association of Environmental and Resource Economists, and the Econometric Society. I have attached a copy of my curriculum vitae as Appendix 1 to this report.

## EXECUTIVE SUMMARY

The purpose of this report is to provide the Court with my expert opinion on the Clean Water Act penalty that Anadarko should pay as a result of its involvement as a non-culpable, non-operating investor in the Macondo 252 lease and exploratory well. Based upon my professional expertise in the field of environmental economics; my understanding of the economic, social, and environmental policies intended to be furthered by the Clean Water Act; and my review of operator and non-operator financial and operational relationships in offshore oil and gas exploration and production, I conclude that no civil penalty should be imposed on Anadarko.<sup>1</sup>

**In Section I**, I explain how compensatory damages under the Oil Pollution Act (OPA) and civil penalties under Section 311 of the Clean Water Act (CWA) work together to deter and punish oil spills. I conclude that optimal deterrence can be achieved in this case without imposing CWA §311 civil penalties on Anadarko because Anadarko already has paid \$4 billion to compensate injuries caused by the oil spill. Nor would absolute deterrence be achieved by imposing civil penalties on Anadarko because it had no culpability and received no economic benefit from, the violations. Recognizing that the Court nevertheless must consider imposing penalties in all cases, I also explain how economic principles of efficient deterrence—which take into account transaction costs and the dynamics of investor-operator relations—should guide the assessment of penalties. Here, imposing a penalty on a non-culpable entity like Anadarko would not achieve efficient deterrence and could in fact be counterproductive to the CWA’s goals. I therefore conclude that, for Anadarko, culpability is most important among the eight CWA §311 factors. There is, in short, no sound economic rationale for punishing a non-operating, non-culpable investor like Anadarko.

**In Section II**, I present evidence of a change in the capital market for deepwater operations in the Gulf of Mexico since MOEX and Anadarko were named co-defendants in this lawsuit on December 15, 2010. In particular, I find that (i) there has been a significant exit of investors from the market and (ii) there has been a significant increase in the concentration of title shares in Gulf of Mexico leases. This empirical evidence supports my argument that the potential increase in liability exposure for non-operating investors such as Anadarko and MOEX will hamper capital investment in deepwater drilling ventures by leading to greater concentration of title shares and fewer investors. This will disrupt the capital markets and curtail participation by passive investors. I also show in Section II that those consequences will have significant regional and national economic implications, whether intended or unintended.

[REDACTED]

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<sup>1</sup> I am not rendering an opinion on the legal question whether CWA §311 *requires* a court to assess a penalty against each and every owner, operator, and person in charge of a facility or vessel from which oil is discharged. To the extent this Court concludes that some penalty is required against Anadarko, it should be nominal for the reasons discussed herein.

<sup>2</sup> I have not analyzed what penalty, if any, should be assessed against Anadarko’s co-defendant, BP Exploration & Production Inc. (BPXP). Given the individualized nature of the CWA §311 factors and BPXP’s different status and

**I. PENALIZING ANADARKO DOES NOT RATIONALLY DETER OR PUNISH VIOLATIONS OF THE CWA.**

As this Court has noted, OPA and the CWA work together to deter and punish oil spills in waters of the United States.<sup>3</sup> Multiple economic theories of punishment and deterrence each suggest that no CWA §311 penalty should be imposed on Anadarko in this case. **Optimal deterrence** will be achieved by damages alone, for which Anadarko paid \$4 billion to BP. **Absolute deterrence** is not a sound basis for penalizing Anadarko because the government admits Anadarko received no benefit from the violations. Finally, several principles of **efficient deterrence** are violated by imposing penalties on Anadarko.

**A. Federal Law Aims to Deter and Punish Oil Spills.**

Several federal laws work to restore and maintain the waters of the United States. In the Clean Water Act, for instance, Congress established regulatory programs to control point source and certain non-point sources of pollution. When unlawful discharges occur, federal law imposes civil liability for damages (including response costs) under OPA and civil penalties under the CWA.

Damages under Section 1002 of OPA are all-encompassing and compensate victims for nearly all harms caused by an oil spill. They include (i) removal costs; (ii) natural resources damages; (iii) loss of real or personal property; (iv) loss of subsistence use of natural resources; (v) loss of revenues; (vi) loss or impairment of earning capacity; and (vii) damages for the increased costs of providing public services.<sup>4</sup>

Civil penalties for oil spills are imposed under Section 311 of the CWA and are intended to “punish the violator and deter and prevent future violations.”<sup>5</sup> Congress gives courts broad discretion in imposing civil penalties under Section 311, and lists eight factors to consider “[i]n determining the amount of a civil penalty” for an oil spill.<sup>6</sup> The eight factors are: (i) the seriousness of the violation(s); (ii) the defendant’s degree of culpability; (iii) mitigation efforts by the defendant to minimize effects of the discharge; (iv) history of prior violations; (v) other penalties for the same incident; (vi) economic impact of penalty on the defendant; (vii) economic benefit to the defendant resulting from the violation; and (viii) other matters as justice may require.<sup>7</sup>

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role that analysis would differ considerably from my analysis of Anadarko here. I also have not analyzed what penalty, if any, should have been assessed against MOEX and Transocean. Both settled the Government’s claims.

<sup>3</sup> *In re Oil Spill by the Oil Rig “Deepwater Horizon” in the Gulf of Mexico, on April 20, 2010*, 844 F. Supp. 2d 746, 759–760 (E.D. La. 2012).

<sup>4</sup> 33 U.S.C. §2702(b).

<sup>5</sup> 135 Cong. Rec. S11,545 (daily ed. August 2, 1990) (statement of Act’s author, Sen. Lieberman). See also Sen. Bill 686, 101st Cong., at 5 (1st Sess. 1989), which includes a general legislative finding that “there is a need to establish a clear and sufficient structure of penalties to effectively deter those who would discharge oil to the waters of the United States or to punish those who cause such discharges.”

<sup>6</sup> 33 U.S.C. §1321(b)(8).

<sup>7</sup> *Id.*

Federal law thus creates a fundamental distinction in the manner in which oil spill liability is assigned. OPA compensatory damages are imposed via strict liability and are determined by the magnitude of harms caused by the spill. CWA §311 civil penalties, by contrast, are not intended to allocate proportionate liability for costs and damages, but rather to target a specific penalty to a specific defendant. Indeed, the eight factors a court must consider in assessing a CWA §311 penalty are defendant-specific. Thus, as this Court noted, a §311 penalty is “‘tailored’ to the specific defendant and situation, and an amount appropriate for one defendant might be ineffective (or grossly excessive) for another.”<sup>8</sup>

## **B. In This Case, OPA Liability by Itself Achieves Optimal Deterrence.**

As a matter of economics, civil liability for damages under OPA and civil penalties under CWA §311 have the same effect on regulated entities—deterrence. The deterrent effect of damages is widely recognized. Penalties also have a deterrent effect. The economics literature on penalties was pioneered by the Nobel Prize-winning economist Gary Becker (1968), who identified the role of penalties as a means of internalizing social cost. He demonstrated that it is possible to achieve a particular level of deterrence equivalently either by increasing the size of the penalty or by increasing the probability of a penalty being imposed.<sup>9</sup>

**Optimal deterrence** in economics is the level of deterrence achieved when the total amount charged for an offense equals the total amount of harm done, divided by the probability of being charged (Shavell 1980, 1987, 2010; Landes and Posner 1987; Polinsky and Rubinfeld 1988; Polinsky and Shavell 1998, 2014).<sup>10</sup> If the expected charge is below the optimal level, enterprises engaged in risky activities are encouraged to take less-than-optimal precautions, and accidents will be under-deterred. If the expected charge exceeds the optimal level, it will discourage economically efficient activities, leading to low levels of investment and an undesirable reduction in desirable economic activity (Viscusi and Zeckhauser 2011).<sup>11</sup> In other words, “wasteful precautions may be taken, (consumer) prices may be inappropriately high, and risky but socially beneficial activities may be undesirably curtailed,” (Polinsky and Shavell

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<sup>8</sup> Order and Reasons as to Transocean and BP’s Cross-Motions for the Partial Summary Judgment Regarding Indemnity [Rec. Doc. 5446] at 21.

<sup>9</sup> Becker, G. 1968. “Crime and Punishment: An Economic Approach.” *Journal of Political Economy* 76, pp. 169-217.

<sup>10</sup> Shavell, S. 1980. “Strict Liability versus Negligence.” *Journal of Legal Studies* 9(1), pp. 1-25; Shavell, S. 1987. *Economic Analysis of Accident Law*. Cambridge: Harvard University Press; Shavell, S. 2010. “The Corrective Tax versus Liability as Solutions to the Problem of Harmful Externalities.” Harvard, John M. Olin Center for Law, Economics and Business Discussion Paper No. 672, 2010; Landes, W.M., and R. A. Posner. 1987. *The Economic Structure of Tort Law*. Cambridge: Harvard University Press; Polinsky, A. M. and D. L. Rubinfeld. 1988. “The Welfare Implications of Costly Litigation for the Level of Liability.” *Journal of Legal Studies* 17, pp. 151-64; Polinsky M.A. and S. Shavell, 1998. “Punitive damages: An economic analysis,” *Harvard Law Review* 111(4), pp. 869-962; Polinsky, M.A., and S. Shavell. 2014. “Costly Litigation and Optimal Damages.” *International Review of Law and Economics* 37(1), March 2014, pp. 86-99.

<sup>11</sup> Viscusi, W. K. and R.J. Zeckhauser. 2011. “Deterring and Compensating Oil-Spill Catastrophes: The Need for Strict and Two-Tier Liability.” *Vanderbilt Law Review* 64(6), pp. 1717-1765.

1998).<sup>12</sup> The EPA's Science Advisory Board is on record as concurring with this basic economic principle.<sup>13</sup>

From an economic perspective, civil penalties are not always needed to achieve optimal deterrence. When damages liability is close to the total amount of harm done, and when the probability of having to pay those damages is high, civil penalties would likely over-deter because the total expected charge will exceed the optimal level. In this litigation, OPA damages by themselves should achieve economically optimal deterrence. Environmental damages will be determined and assessed, and a compensation fund has been established for other types of consequential damages, including thousands of individual claims for damages. Because full payment of actual external damages typically leads to optimal deterrence, there is good reason to believe that OPA damages in this litigation, for which responsible parties are strictly liable, will be sufficient to achieve optimal deterrence. Anadarko has paid \$4 billion in damages already – an amount equal to nearly 8% of its entire market capitalization. Making Anadarko pay more by imposing civil penalties under CWA §311, then, would result in over-deterrence above the optimal level.

**C. CWA §311 Penalties Against Anadarko Cannot be Justified to Achieve Absolute Deterrence; Here the Company Was Not Culpable and Did Not Benefit From the Violations.**

While economic theory supports the goal of achieving optimal deterrence of environmental violations—indeed, even the EPA Science Advisory Board recommended this approach when formulating civil penalties—federal policy does not stop at optimal deterrence of oil spills. Courts must consider imposing civil penalties under CWA §311 for every oil spill—whether or not OPA damages achieve optimal deterrence.<sup>14</sup> When enacted in 1972, the Clean Water Act had a stated objective of preventing all illegal discharges into waters of the United States by 1985—an objective of **absolute deterrence**.<sup>15</sup> Yet just as civil penalties are not needed to achieve optimal deterrence against Anadarko, they also are not needed to achieve absolute deterrence.

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<sup>12</sup> Polinsky, M.A. and S. Shavell, 1998. "Punitive Damages: An Economic Analysis." *Harvard Law Review* 111(4), at 874.

<sup>13</sup> EPA's SAB has written that "pollution is a 'conditionally deterred' offense – one that we only want to prohibit when its overall social costs exceed its overall social benefits. If the expected penalty greatly exceeds the expected benefit to the offender and yet the harm from the offense is relatively minor, the result will likely be 'over deterrence.'" EPA Science Advisory Board, EPA-SAB-ADV-05-003, "An Advisory of the Illegal Competitive Advantage (ICA) Economic Benefit (EB) Advisory Panel of the EPA Science Advisory Board," (hereafter "SAB"), at 25-26. Available at: [http://yosemite.epa.gov/sab/sabproduct.nsf/05C624772F33C2B08525708100727D55/\\$File/ica\\_eb\\_sab-adv-05-003.pdf](http://yosemite.epa.gov/sab/sabproduct.nsf/05C624772F33C2B08525708100727D55/$File/ica_eb_sab-adv-05-003.pdf).

<sup>14</sup> I am not rendering an opinion on the legal question whether Section 311 of the CWA *requires* a court to assess a penalty against each and every owner, operator, and person in charge of a facility or vessel from which oil is discharged—even one who is not culpable.

<sup>15</sup> 33 U.S.C. §1251(a)(2). I note that, since it is impossible to drive the probability of an accident to zero, this objective cannot be accomplished unless the Government prohibits all offshore exploration and production – something it has also determined is not in the national interest. See Dwyer, J. 1990. "The Pathology of Symbolic Legislation." *Environmental Law Quarterly* 17, pp. 233-316.



The economics of penalties as a means of achieving absolute deterrence was analyzed by Posner (1985).<sup>16</sup> Whereas Becker developed the case for using penalties to internalize social costs and incentivize optimal behavior, Posner showed that, to achieve absolute deterrence, penalties should be set to eliminate the prospect of gain on the part of the violator.<sup>17</sup> There is a functional distinction between the two approaches to penalties. In cases where the violation causes modest external damage but the violator receives a large economic benefit, a charge based on actual damage will not absolutely deter the violation; so, to achieve absolute deterrence in those cases, it is necessary to impose a penalty that exceeds civil damages and deprives the violator of all gains from the violation. In cases where the external damages exceed the violator's economic benefit, absolute deterrence is achieved solely by making the violator pay for those damages, so no additional penalty is warranted.

Posner's construction of penalties as a means of achieving absolute deterrence supports my view that Anadarko should pay no civil penalty in this case. This Court has already found that Anadarko was not culpable and, in fact, was not responsible for the drilling operations on the rig.<sup>18</sup> Further, the United States has agreed that there was no economic benefit to Anadarko from the alleged violations.<sup>19</sup> Since Anadarko is not culpable, received no economic benefit as a result of the violations, and has paid \$4 billion in damages, there is no sound economic rationale for punishing Anadarko with the goal of achieving absolute deterrence.

**D. Punishing Anadarko Serves no Sound Purpose Under the Clean Water Act and Could Be Counterproductive.**

Economic theory also plays an important role in applying the CWA §311 factors so that penalties are not applied indiscriminately or contrary to the purposes of the Clean Water Act. In particular, economic principles of **efficient deterrence** can ensure that a penalty—whether optimally deterrent, absolutely deterrent, or something else entirely—is imposed efficiently and in a way that advances the penalty's deterrent effect.

One might think that imposing a penalty on a non-operating investor—even one found not culpable, like Anadarko—would achieve a degree of deterrence insofar as it would encourage investors to exercise oversight in the future. But that is not necessarily the case. There is extensive literature in environmental economics addressing the question of allocating liability among multiple parties to an accident. The literature shows that penalizing a non-culpable, non-operating investor does not result in rational or efficient deterrence, and could be counterproductive. Accordingly, culpability should be the most important factor in this Court's consideration of the government's request to impose CWA §311 penalties on Anadarko.

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<sup>16</sup> Posner, R. 1985. "An Economic Theory of the Criminal Law." *Columbia Law Review* 85(6), pp. 1193-1231. Posner's paper is concerned with criminal offenses such as murder, rape and theft for which there is no socially "optimal" level. Posner (1985) and Becker (1968) are the two foundational papers in the economics of penalties, and both are highly influential in the field of environmental economics.

<sup>17</sup> Consistent with Posner's formulation, the Fifth Circuit has termed the economic benefit factor the "starting point" for the determination of a CWA civil penalty.

<sup>18</sup> *In re Oil Spill by the Oil Rig "Deepwater Horizon" in the Gulf of Mexico, on April 20, 2010*, 808 F. Supp. 2d 943, 963 (E.D. La. 2011).

<sup>19</sup> Tr. of Status Conference Re: Penalty Phase on March 21, 2014 at 26-27.

## *1. Transaction costs*

To begin, it is important to note that economists often assume that market participants have the ability to reallocate expected liability through bargaining and private transactions, a phenomenon first described by Coase (1960).<sup>20</sup> The Coase Theorem predicts that, absent transaction costs, the market will respond to any assignment of liability between “operators” and “investors” by designing contracts to internalize externalities that exist between the contracting parties.<sup>21</sup> In the simplified world of Coase, because parties are expected to shift the cost of liability among themselves, the government’s assignment of liability to any particular party would be irrelevant.<sup>22</sup>

Of course, markets are rarely frictionless, and transaction costs may preclude operators and investors from successfully negotiating agreements that efficiently reassign liability. In the real world, the imposition of penalties on particular entities must be justified on cost-benefit grounds. Imposing penalties on the “wrong” entity can have significant negative consequences, as that entity may not be able to shift the cost of penalties to the “right” entity or may be able to do so only after incurring substantial (unnecessary) transaction costs. The next part of this subsection explains some of the problems that arise from shifting liability from operators to investors.

## *2. Information asymmetry, lack of control, and moral hazard*

Economists generally have concluded that it is inefficient to penalize non-culpable investors in operations that cause pollution, and that such penalties are warranted only in cases that do not apply to Anadarko here. In addition to the transaction costs described above, the general concern is that relations between investors and operators are usually characterized by information asymmetry: the operator usually has superior information about the day-to-day activities that influence production and safety outcomes.

A vast economics literature beginning with Mirrlees (1976) and Hölmstrom (1979, 1982) has considered the economics of the operator-investor relationship in the face of asymmetric information (what economists refer to as a situation of “moral hazard”), and the types of contracts between operators and investors that may be expected to emerge from these situations. In general, investors not only have imperfect information; they also have an imperfect ability to control operators. It is difficult for investors to induce operators to behave optimally, particularly when doing so is costly.

The standard model of moral hazard shows that, when both investor and operator are well capitalized (*i.e.* when the operator is not judgment-proof), there is no social gain from assigning liability to the investor.<sup>23</sup> In fact, when an investor cannot observe and control the safety measures undertaken by an operator, but is forced to share in liability and penalties, extending

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<sup>20</sup> Coase, R. 1960. “The Problem of Social Cost.” *Journal of Law and Economics* 3, pp. 1-44.

<sup>21</sup> I do not use the terms “operator” and “investor” with any maritime or legal meaning. Instead, I mean the entity actually doing the work (“operator”) and the entity that provides capital for the work (“investor”).

<sup>22</sup> What is more consequential in this circumstance is the *total* liability and penalties across all contracting parties resulting from a particular incident.

<sup>23</sup> See, for example, Laffont, J. J. 1995. “Regulation, Moral Hazard and Insurance of Environmental Risks.” *Journal of Public Economics* 58, pp. 319-336.

liability from operator to investor can lead to *decreased* investment in safety by the operator because the operator does not bear the entire cost of an accident. Thus, because of the practical limits on an investor's access to information and its ability to induce or supervise an operator's safety investment, it is not efficient to impose penalties on non-culpable investors.<sup>24</sup>

### ***3. Increased costs of capital and potential increases in the likelihood of accidents***

Penalizing non-culpable investors for discharges results in other inefficiencies because it raises the cost of capital paid by operators. Boyd and Ingberman (1997) show that extending penalties to non-culpable investors leads to two types of cost-increasing distortions of the capital market.<sup>25</sup> First, investors will respond by reducing investment—some even might leave the market entirely—which makes capital harder to acquire and thus raises the cost of capital for operators.<sup>26</sup> Second, it will distort the pattern of transactions between operators and investors and incentivize investors to choose among potential operators by placing greater weight on an operator's finances relative to its abilities or skills.

Extending civil penalties to investors can *increase* the frequency of oil spills. As Pitchford (1995) demonstrates,<sup>27</sup> a non-culpable investor facing a risk of penalties from actions outside its control will demand a higher rate of return on its investment to compensate for the increased exposure to risk—much like a bank charges a higher interest rate on a riskier loan. A higher rate of return for an investor means a lower rate of return for an operator; in effect, the operator is giving some of its return to the investor. To raise its rate of return, the operator may cut corners on safety expenditures. Indeed, it may be economically rational for the operator to do so. From the perspective of an operator facing a reduced rate of return, the marginal benefit of accident prevention decreases, but the marginal cost of an accident does not (because the investor shoulders some of the cost of penalties). As a result, the risk of an accident increases.

Because of transaction costs, information asymmetry, lack of control, moral hazard, and the consequences of increased cost of capital, imposing penalties on non-culpable investors is economically inefficient and could be counter-productive. As a matter of economic theory, culpability is the critically significant factor under CWA §311 in cases where the Government is trying to impose penalties on a non-operating investor. If civil penalties are to be imposed for an oil spill (above and beyond compensatory damages), it is more efficient to impose them on the entities with information and actual control over the operation and potential violations.

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<sup>24</sup> A possible exception to this outcome occurs when the operator has limited assets. This circumstance is not relevant to the calculation of civil penalties associated with the *Deepwater Horizon* incident.

<sup>25</sup> Boyd, J. and D.E. Ingberman, 1997, "The Search for Deep Pockets: Is 'Extended Liability' Expensive Liability?" *Journal of Law, Economics and Organization* 13: 232-258.

<sup>26</sup> In the case where the operator is fully capitalized, as is the case with the *Deepwater Horizon* incident, there is no corresponding gain in cost internalization and the reduction in capital investment is inefficient.

<sup>27</sup> Pitchford, R., 1995, "How Liable Should the Lender Be? The Case of Judgment-Proof Firms and Environmental Risks," *American Economic Review* 85, 1171-1186.

## II. IMPOSING PENALTIES ON NON-OPERATING INVESTORS WILL DETER CAPITAL INVESTMENT IN DEEPWATER EXPLORATION AND PRODUCTION AND WILL HAVE A RIPPLE EFFECT IN THE GULF STATES' ECONOMIES.

Deepwater drilling requires substantial capital investment. For example, to begin production at its Tahiti lease in the Gulf of Mexico, Chevron estimated that it would take seven years and \$4.7 billion to construct the infrastructure for drilling at a depth of 4,000 feet.<sup>28</sup> One estimate of the cost of deepwater exploration and development is \$200,000 to \$759,000 per site per day.<sup>29</sup>

To raise all this capital, offshore oil and gas operations are financed by a competitive, global capital market. Operators enter into agreements with non-operating investors to raise capital, allocate responsibilities, and distribute proceeds.<sup>30</sup> These financing arrangements are particularly important for exploration, development, and production.<sup>31</sup> Access to capital from non-operating investors is essential for operators to engage in safe and successful deepwater drilling ventures.

Because the Government's attempt to impose penalties on non-culpable investors in offshore oil and gas operations is unprecedented, and because the amount of the penalties is substantial (Anadarko's maximum potential penalty is more than 10% of its market capitalization), economically rational non-operating investors throughout the market will respond. They will reexamine past investments and scrutinize new investments in light of the possibility of being held liable for substantial penalties. In this section, I describe the potential market responses, and present empirical evidence that they appear to have occurred in the four years since the Government named MOEX and Anadarko as defendants in this litigation. Indeed, MOEX has left the market entirely, and the evidence suggests that the prospect of civil penalties liability has kept other non-operating investors out of the market. In addition, the evidence shows that ownership interests in deepwater leases have become more concentrated, a finding that is consistent with the evidence that non-operating investors are leaving and avoiding the market. I conclude by describing the economic linkage between oil and gas exploration and production operations and the economies of the Gulf States.

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<sup>28</sup> Statement of Peter J. Robertson, Vice Chairman, Chevron Corporation before the U.S. House of Representatives Select Committee on Energy Independence and Global Warming Tuesday, April 1, 2008.

<sup>29</sup> Statement of John Hofmeister, President, Shell Oil Company before the U.S. House of Representatives Select Committee on Energy Independence and Global Warming Tuesday, April 1, 2008.

<sup>30</sup> For comprehensive surveys of the literature on production joint ventures, see Jorde, T. M., and D.J. Teece (1990). "Innovation and cooperation: implications for competition and antitrust." *The Journal of Economic Perspectives*, 75-96 and Shapiro, C. and R.D. Willig (1990). "On the antitrust treatment of production joint ventures." *The Journal of Economic Perspectives*, 113-130.

<sup>31</sup> Ernst & Young, 2011, "Navigating Joint Ventures in the Oil and Gas Industry." Available at: [http://www.ey.com/Publication/vwLUAssets/Navigating\\_joint\\_ventures\\_in\\_oil\\_and\\_gas\\_industry/\\$FILE/Navigating\\_joint\\_ventures\\_in\\_oil\\_and\\_gas\\_industry.pdf](http://www.ey.com/Publication/vwLUAssets/Navigating_joint_ventures_in_oil_and_gas_industry/$FILE/Navigating_joint_ventures_in_oil_and_gas_industry.pdf).

**A. Since the Government’s Attempt to Penalize Anadarko and MOEX, Investors have Exited and Avoided the Deepwater Market at Increasing Rates.**

The pool of potential investors in deepwater operations is not static. Each year, some investors leave the market and some enter. An investor that leaves the market takes its capital with it, and an investor that enters the market brings new capital. So, when an investor leaves, the marketwide supply curve shifts in and the cost of capital rises, achieving a new equilibrium. Conversely, when an investor enters, the marketwide supply curve shifts out and the cost of capital falls, achieving another new equilibrium.

I have examined how the Government’s attempt to impose substantial civil penalties on Anadarko and MOEX has affected the entry and exit rates of non-operating investors in deepwater operations. I find that there has been a significant *increase* in the exit of non-operating investors in deepwater Gulf leases since December 15, 2010, when MOEX and Anadarko were named co-defendants in this lawsuit. And I find that there has been a significant *decrease* in the entry of non-operating investors in deepwater Gulf leases since December 15, 2010. This empirical evidence supports my argument in Section I that civil penalty liability for non-operating investors can disrupt capital formation by increasing the investors’ risk and leading them to exit the industry.

I began with data from the Bureau of Ocean Energy Management (BOEM), which details information about leases in the Gulf of Mexico beginning in 1982. Because BOEM classifies the lease at issue in this case—lease G32306 (Macondo Prospect - Mississippi Canyon Block 252)—in the 1,000+ meter depth category, I considered only other leases in that same category. I removed the leases where the information was incomplete and title shares in the data did not add up to 100% at each point in time, which left me with the vast majority of all leases in the data set (90.5%).<sup>32</sup>

For each lease, BOEM lists the MMS IDs of each investor in the lease. MMS IDs are company-specific, so a parent company and its subsidiaries all have different MMS IDs. I aggregated MMS IDs, grouping them by corporate family. For example, Anadarko E&P Company LP, Anadarko Petroleum Corporation, and Anadarko US Offshore Corporation have three different MMS IDs; instead of using all three, I created a single, unique investor-level ID to represent the Anadarko family of companies. Aggregating investors in this way is conservative for purposes of my analysis because a single subsidiary’s entrance or exit from the market is not counted if its parent or other subsidiaries in the corporate family remain in the market.<sup>33</sup>

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<sup>32</sup> Title share is defined as a lessee’s financial interest in a lease. See BOEM, *Field Definitions for Lease Owner*, [http://www.data.boem.gov/itaccessproj/AccessTableInfo/LeaseOwner\(Access\)dfn.asp](http://www.data.boem.gov/itaccessproj/AccessTableInfo/LeaseOwner(Access)dfn.asp).

<sup>33</sup> Merger activity can exaggerate entrance and exit as well. To account for merger activity, I used BOEM’s all company data file (BOEM, *All Company Datafile*, <http://www.data.boem.gov/homepg/pubinfo/freearsci/leasing/zipped/delimit/compall.zip>), which contains a termination code for all investors whose MMS ID was terminated. If an investor’s code indicated a merger, I assigned one unique investor-level ID to both investors for the entire sample. I also constructed a mapping of MMS IDs into current-day merged entities using the best available industry information. The mapping of investors is provided in Appendix 2.

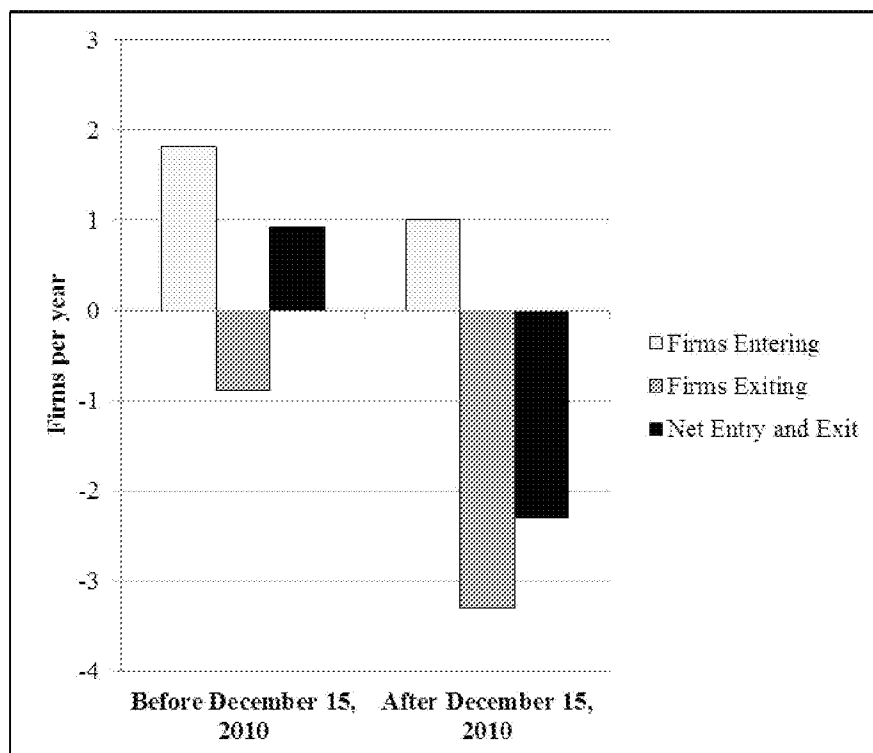
Using my investor-level IDs, I defined a date of entry for each investor, which is the first time BOEM recorded the investor as holding a title share in a lease in the Gulf of Mexico at a depth of 1,000 meters or more. I also defined a date of exit, which is either the last date the investor appears on any lease at 1,000 meters or more or the expiration date of the lease, whichever comes first. For each year between 1983 and 2013 (31 observations in total), I counted the number of entries and number of exits by investor. (I did not use data for 2014 as the year has not yet ended.)

I observed the designated operator for each lease at each point in time. I was able to identify the non-operating deepwater investors—*i.e.* the investors that are never listed as a designated operator on any lease in the data set. These firms simply provide capital to the 1,000+ meter market and have no operational control in the deepwater market. (Some of these firms might be designated operators in shallower water.)

Figure 1 depicts my findings. On average, before December 15, 2010, 1.82 non-operating investors entered the deepwater market and 0.89 non-operating investors exited each year. Thus, the net entry rate before December 15, 2010 was .93 investor per year. This indicates annually increasing competition in the relevant capital market. After December 15, 2010 the rate of entry has slowed to 1 investor per year and the rate of exit has increased to 3.3 per year. Thus, the net exit rate since December 15, 2010 is 2.3 investors per year. This swing alone suggests that there has been a significant change in the deepwater capital market.

**Figure 1**

Annual entry and exit rates of non-operating investors in deepwater (1,000+m) leases, 1983–2013



A simple before-and-after comparison sometimes can overlook an underlying trend in the exit or entry data. To test statistically whether the entry and exit rates have accelerated since December 15, 2010, I constructed a generalized linear model and performed two regressions—one for entry, one for exit—that regress the annual count of entering or exiting firms on a linear time trend and an indicator variable that distinguishes between the pre- and post-December 15, 2010 time periods.<sup>34</sup> The estimation results are reported in Table 1.

**Table 1**

Generalized linear model Poisson entry and exit regression results for leases at 1,000+m

	Entering Non-operating Investor Counts	Exiting Non-operating Investor Counts
Estimated Change post 2010:	-1.351*** (0.178)	1.443*** (0.372)
Observations	31	31
AIC	3.540	2.987

Newey-West HAC robust standard errors in brackets are listed below the coefficients, which are reported as marginal effects. Both regressions control for a time trend.  
\*\*\* Significant at 1% level

The first column compares the number of non-operating investors that annually enter the deepwater market after December 15, 2010 to the number that entered before; the second column examines exits. Since December 15, 2010, the exit rate has picked up (1.443) and the entry rate has slowed down (-1.351). The results further suggest that we can rule out that there has been no effect at a level of confidence greater than 99%. (At a level of 95% confidence, the estimated change in entry rate decreased between 1 and 1.70 investors annually, and the estimated change in exit rate increased between .71 and 2.17 investors annually.)

Thus, the combined effect of more than doubling the exit rate of existing investors and slowing down significantly the entry rate of new investors is a source of lost capital investment, both old and new. And closer inspection of the investors that no longer appear on leases of depths greater than 1000 meters since December 15, 2010 reveals that the companies leaving the industry are not oil majors. The non-operating investors exiting the market are:

- MOEX Offshore 2007 LLC,
- Merit,
- GDF SUEZ,
- Dorado Deep GP, LLC,

<sup>34</sup> The generalized linear model takes into account that the outcome variable (“entry” or “exit”) is in count data form (Poisson with canonical link) and further allows for dependent error terms.

- Challenger Minerals Inc.,
- Palace Exploration Company,
- CL&F Resources LP,
- Arena Exploration LLC,
- St. Mary Energy Company, and
- Black Elk Energy Offshore Operations, LLC.

My analysis is likely conservative due to the relatively short time frame since December 15, 2010, and the inherent time lags necessary to institute a change in ownership structure. MOEX, for example, did not formally “exit” the deepwater market until October 24, 2011, nearly a year after it was named a co-defendant. Other investors may be considering exiting the market as well, but have not re-assigned their lease shares and may be awaiting their expiration instead.

**B. Deepwater Lease Shares Have Become More Concentrated Since December 15, 2010.**

The title shares of investors in a lease are usually allocated in proportion to their capital investments. Increased concentration of title shares can be evidence of market problems. To the extent that a rise in title share concentration is driven by the exit of small investors from the market, it suggests that less capital is flowing into the market. In this section, I consider whether title share allocation can be affected by an increase in expected liability for oil spills. I find that there has been a significant increase in the concentration of title shares in Gulf leases since December 15, 2010, when MOEX and Anadarko were named co-defendants in this lawsuit. This empirical evidence supports my argument that the threat of civil penalty liability for non-operating investors can disrupt capital formation and lead non-operating investors to exit the industry. This empirical evidence also supports my findings that non-operating investors have exited the industry at an increasing rate since December 15, 2010.

To measure whether there has been a detectable change in the allocation of title shares, I construct a measure commonly used in the analysis of market power, the so-called Herfindahl index (HHI) of market concentration. The HHI sums the squares of each investor’s share in a lease. So, for example, if a single investor holds 100% of the title, the index is equal to 1. If five investors each hold 20%, the index is 0.2 ( $.2^2 + .2^2 + .2^2 + .2^2 + .2^2$ ). And if one investor holds 55% and another holds 45%, the index is .505 ( $.55^2 + .45^2$ ). The higher the index, the more concentrated the ownership structure of the leases.

I began with the same data and aggregation that I described above. Due to the rapidly changing nature of the industry and available technology, I limited the data set to title share changes starting in 2000 and observed the title shares for each lease. This data set contains many observations that do not indicate a change in title share (like a change in a company’s name). I therefore recorded only observations that showed a change in title shares from the previous filing—9,121 observations in total. Next, I regressed the HHI of the leases with a linear time



trend and an indicator variable that distinguishes between the pre- and post-2011 time periods.<sup>35</sup> Table 2 shows the results.

**Table 2**  
HHI regression results for leases at 1,000+ m

Variable	HHI Index
Post-December 15, 2010 Impact	0.0583*** (0.020)
Observations	9,121
Time Trend Included	Yes
Lease Fixed Effects Included	Yes
R-squared	0.088
Number of groups	5,632

Robust clustered standard errors in parentheses

\*\*\* Significant at 1% level

Since December 15, 2010, the HHI has increased by 0.0583, which corresponds to an 8% increase in the concentration of title shares.<sup>36</sup> (Using one of the HHI examples given above, an 8% increase in the HHI is what happens when one investor holding 20% of a lease exits the market and sells its share to one of the other four lessees ( $.2^2 + .2^2 + .2^2 + .4^2 = .28$ .) My analysis indicates that the increase in the HHI is statistically significant at the 99% confidence level. This finding is consistent with a disruption in the structure of capital markets due to an attempt to extend penalty liability to non-operating investors and a curtailment in their participation in deepwater drilling ventures.

**C. Imposing Penalties on Non-culpable Non-operating Investors Has Consequences for the Economies of the Gulf States.**

Increasing the cost of offshore oil and gas operations not only will harm capital formation in the industry, it also will have significant regional and national economic implications.

Capital investment in the oil and gas sector in the Gulf of Mexico is a key driver of economic activity in the region. For States bordering the Western and Central Gulf, the oil and gas sector accounts for 2.6 million direct, indirect, and induced high-paying jobs and \$402.6 billion in Gross State Product, making the sector one of the most important in the region at current levels

<sup>35</sup> I also controlled for fixed effects, effects which vary based on entity but do not vary over time, to account for differences in these unobservable lease characteristics.

<sup>36</sup> To test the validity of this date, I ran analyses using the dates one year before and after December 15, 2010. The results for those other dates cannot rule out a zero effect, which suggests that December 15, 2010 is the date of economic significance.

of exploration.<sup>37</sup> In the State of Louisiana, 26.7% of direct, indirect, and induced jobs can be attributed to the oil and gas industry (Mississippi: 11.6%; Texas: 21.6%; Alabama: 7%).<sup>38</sup> These jobs (excluding gas station employment) pay 97% above the State mean salary in Louisiana (Mississippi: 103%; Texas: 131%; Alabama: 58%).<sup>39</sup> Overall, the oil and gas industry contributes 35% of Louisiana's Gross State Product (Mississippi: 9.4%; Texas: 23.2%; Alabama: 6.4%).<sup>40</sup>

Operators and non-operating investors in the Gulf of Mexico make large capital investments in offshore exploration, development, and production. These capital expenditures increase the demand for inputs such as labor, physical structures, support materials, and transportation that provide required services for deepwater exploration and development. Expenditures on deepwater exploration and development contribute directly to the industries and sectors producing these materials and generate economic activity that supports job creation in the region and in the nation.

Investment in oil and gas exploration and development also stimulates the regional and national economy through three types of effects that economists term direct, indirect, and induced impacts. Direct impacts reflect the initial change in economic activity from investment. Indirect impacts result from local "business-to-business" transactions necessary to support the direct activity, like local purchase of physical materials, engineering and consulting services, and other goods purchased from supporting industries. Induced impacts result when the increased earnings generated by the direct and indirect economic activity are spent on local goods and services, like when workers purchase food, clothing, automobiles, real estate, education, health and social services. Induced spending creates incomes in affiliated industries, which the owners of these businesses turn around and spend elsewhere. The creation of indirect and induced impacts in affiliated sectors of the economy is the basic logic behind economic multipliers.

To measure the importance of the economic linkages, I asked the U.S. Bureau of Economic Analysis to construct a set of RIMSII multipliers for the region containing Alabama, Louisiana, Mississippi, and Texas. These multipliers capture the direct, indirect, and induced effects referred to above. The multiplier for the category of "drilling oil and gas wells" is 2.33. Thus, for these states, each \$1 billion spent on drilling oil and gas wells results in \$2.33 billion of output in the Gulf States (excluding Florida), leading to the creation of 12,184 new jobs and \$1.1871 billion in value added.<sup>41</sup>

While it is certainly true that the size and importance of an industry does not relieve its burden to comply with environmental laws, the data in this section show that there is more at stake in this case than simply the potential impact of a penalty on a non-culpable, non-operating investor. Because the economies of the Gulf States are influenced in important ways by investment in the

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<sup>37</sup> American Petroleum Institute, Energy Works Map for Louisiana, Texas, Alabama, Mississippi, <http://www.api.org/policy-and-issues/policy-items/jobs/energy-works.aspx> accessed on July 15th 2014.

<sup>38</sup> Id.

<sup>39</sup> Id.

<sup>40</sup> Id.

<sup>41</sup> Personal Communication from the Bureau of Economic Analysis, *RIMS II Multipliers* (to be produced with this report).

oil and gas sector, disincentivizing investment in these industries can have important social consequences in the Gulf region and beyond.<sup>42</sup>

**III. ASSESSING A PENALTY AGAINST ANADARKO IN THIS CASE WOULD SERVE NO PURPOSE UNDER THE CWA.**

**A. No Penalty Is Warranted Against Anadarko.**

Non-operating investors in offshore oil and gas operations typically have little control over daily operations. Consistent with this fact, the Court has already determined that Anadarko was not responsible for the drilling operations on the *Deepwater Horizon* and has no culpability for the oil spill. Accordingly, it is important to consider whether the punishment and deterrence objectives of CWA §311 would be served by imposing a penalty on Anadarko. As explained in Part I of this Report, imposing CWA §311 penalties on a non-culpable investor like Anadarko is inefficient and counter-productive. And as explained in Part II, the empirical data supports and bolsters the theoretical conclusion that the mere prospect of imposing CWA §311 penalties on a non-culpable investor has deterred and will deter investment in deepwater oil and gas operations.

The Government has argued that Anadarko should pay a CWA penalty simply because it expected to profit from its investment in the Macondo well. This argument is novel, to say the least; I am not aware of any other CWA case in which the Government has made a similar claim. Seeking a profit is economically rational behavior, not a reason to be punished. OCS oil and gas extraction is costly and risky, and exists because private entities invest their capital in the hope of earning a profit.

The Government also has argued that future oil spills would be deterred by penalizing a non-culpable, non-operating investor in the Macondo well. As explained above, this argument is unsound as a matter of economic theory and public policy. Punishing non-culpable investors creates disincentives for investment—which may “deter” future oil spills only by reducing the number of actual operations, not by making the operations themselves safer.

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<sup>42</sup> The United States also receives significant revenues from offshore exploration and production in the form of bonuses, rents, and royalties. For the offshore Gulf region in 2013, the U.S. government collected \$2.6 billion in bonuses from auctions, \$4.5 billion in royalties, and \$1.6 billion in other revenues, for a total of \$8.7 billion. M. Rose Dep. (June 26, 2014) at 183-84. Indeed, the Secretary of Interior has touted energy revenue as “one of the nation’s largest sources of non-tax revenue. Id. at 195. A significant portion of those funds is reinvested into the surrounding communities. Id. at 195-97.

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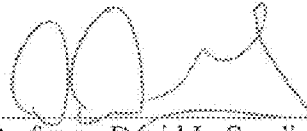
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COMPENSATION

I am being compensated at a rate of \$550 per hour for my work on this case.

Dated: August 15, 2014

A handwritten signature in black ink, appearing to read "David L. Sunding", written over a horizontal dotted line.

Professor David L. Sunding  
Berkeley, California

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