

# HINDSIGHT REGULATION OF HYDROCARBON EXPLORATION: LESSONS FROM ISRAEL’S GAS BONANZAS

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**Synopsis:** Behavioral scientific research reveals that retrospective evaluations of probability tend to be skewed by “hindsight bias.” This insight is applied, in this article, to the regulatory regimes that govern oil and gas exploration. These regimes rely on ex ante assessments of the prospects of exploration to determine what oil and gas developers’ rewards should be. If exploration is ultimately successful, it will tend to appear, in hindsight, more promising than it had been in fact—and pressure will arise to adjust developers’ rewards retroactively. The article argues that this scenario is worrisome, and explores this concern both in the abstract and as applied to a recent case study from Israel. It also examines several approaches toward addressing this concern, including, most promisingly, the United States’ model of private oil and gas rights.

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## I. INTRODUCTION

Crude oil and natural gas, or just “oil” and “gas,” play pivotal roles in the world’s energy production. In 2010, they accounted, together, for 69% of energy

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use worldwide.<sup>1</sup> Oil and gas developers, who are usually large corporations, drill on- and off-shore wells to extract oil and gas from underground reservoirs. A given reservoir usually provides both oil and gas. Reservoirs lie at varying depths, ranging from hundreds of feet to tens of thousands of feet below ground (or sea).<sup>2</sup>

Efforts to discover commercially viable reservoirs of oil and gas are known as hydrocarbon exploration. Exploration consists primarily of seismic surveys and exploratory drilling.<sup>3</sup> Exploration projects are expensive, and their rewards are highly uncertain. Any given project will only be profitable if it unearths a substantial source of oil and gas, and if the costs of extraction from this source are not prohibitive. But “more often than not, a commercial discovery will not occur, in which case it will not be possible to recover the exploration costs.”<sup>4</sup>

An elaborate body of law governs various aspects of oil and gas exploration and development.<sup>5</sup> This article is limited to one facet of oil and gas law: the collection of rules that determines the developer’s share of the profits that will accrue if exploration is successful. These rules—which are generated by legislation, by contracts, and sometimes by administrative guidelines—address three primary questions: Who owns the oil and gas before they are extracted? How will the profits from development be distributed between the pre-extraction owner and the developer? And how will these profits be taxed? I will use the shorthand “exploration regulation” to denote this set of rules taken as a whole.

The aim of this article is to explore a particular concern about exploration regulation. This concern derives from behavioral science, an increasingly prevalent basis for legal policy analysis.<sup>6</sup> The worry is, in brief, as follows: Once an event has come to pass, we tend to overestimate its initial likelihood. This tendency, which is known as “hindsight bias,” is likely to make discoveries of oil and gas seem more probable than they were, in fact, at the outset. This may cause exploration-regulation regimes to appear excessively developer-friendly. In turn, this perception may lead to the enactment of retroactive adjustments to exploration regulation.<sup>7</sup>

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1. INT’L ENERGY AGENCY, 2012 KEY WORLD ENERGY STATISTICS 29 (2012), available at <http://www.iea.org/publications/freepublications/publication/kwes-1.pdf> (oil 48.7%, gas 20.0%). In the United States, oil and gas provided 36% and 24.6%, respectively, of the energy consumed in 2010. U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY REVIEW 2010, at 9 tbl.1.3 (2011), available at <http://205.254.135.24/totalenergy/data/annual/pdf/aer.pdf>.

2. JOHN S. LOWE, OIL AND GAS LAW IN A NUTSHELL 2 (5th ed. 2009).

3. Jubilee Easo, *Licences, Concessions, Production Sharing Agreements and Service Contracts*, in OIL AND GAS: A PRACTICAL HANDBOOK 27, 27 (Geoffrey Picton-Turbervill ed., 2009); HÅVARD DEVOLD, OIL AND GAS PRODUCTION HANDBOOK 23-24 (2009), available at [http://gabinete.org.ar/Setiembre\\_2011/abb.pdf](http://gabinete.org.ar/Setiembre_2011/abb.pdf).

4. Easo, *supra* note 3, at 27.

5. See generally PATRICK H. MARTIN & BRUCE M. KRAMER, THE LAW OF OIL AND GAS (9th ed. 2011); JOHN S. LOWE ET AL., CASES AND MATERIALS ON OIL AND GAS LAW (5th ed. 2008); OWEN L. ANDERSON ET AL., HEMINGWAY OIL AND GAS LAW AND TAXATION (4th ed. 2004).

6. See generally Mark Kelman, *Law and Behavioral Science: Conceptual Overviews*, 97 NW. U. L. REV. 1347 (2003); Russell B. Korobkin, *What Comes After Victory for Behavioral Law and Economics?*, 2011 U. ILL. L. REV. 1653.

7. Since this article treats contractual arrangements as a form of regulation, the terms “adjustments to regulation” and “re-regulation” encompass unilateral modifications of contractual terms. Note that in the United States, governmental re-regulation may be analyzed as a Takings issue. See *infra* note 68.

The core argument of this article is that such “re-regulation” of exploration is indeed worrisome, both in the sense that it is likely and in the sense that it is undesirable. This argument is developed in Part IV, first in the abstract and then as applied to a real-world case study. The bare bones of the case study are these: In 2009, large stores of gas were found off the shores of Israel. These finds led to rigorous public scrutiny of Israel’s regime of exploration regulation, and ultimately to re-regulation of the successful exploration projects. I will suggest that hindsight bias may have played a role in this story. The Israeli case highlights just how crucial regulatory decisions regarding exploration can be, since for geopolitical reasons, homegrown energy sources are extremely important to Israel.

Parts II and III lay the foundations for the arguments of Part IV: Part II analyzes the elements of exploration regulation. Part III outlines the behavioral scientific research on hindsight bias and the legal scholarship that has applied the hindsight-bias insight to the legal decisions of judges and juries. It then suggests that the hindsight-bias problem extends to retroactive regulation.

Part V evaluates a number of approaches toward contending with the hindsight-exploration-regulation concern. Its primary suggestion is that a system of privately owned oil and gas rights, like that of the United States, is likely to diminish the hindsight-regulation worry considerably.

The article concludes with the suggestion that the kind of worry explored here may show up in other regulatory areas as well. It thus points to a danger inherent in (some forms of) retroactive regulation in general. In doing so, it runs counter to a recent body of literature that has taken a benevolent view of retroactive regulation.<sup>8</sup>

## II. EXPLORATION REGULATION

This Part offers a survey of the various elements of exploration regulation: pre-extraction ownership of oil and gas (Section A), contractual arrangements governing exploration (Section B), and taxation of oil and gas profits (Section C). These are the elements that may be susceptible, after oil and gas are found, to hindsight bias-tainted retroactive adjustment. The survey offered here is comparative in nature, but it devotes special attention to American law.

### A. *Pre-Extraction Ownership*

One fundamental choice made by exploration-regulation regimes is whether oil and gas should be available for private ownership. In most countries, all oil and gas, pre-extraction, is government property, even if it is located under privately owned land.<sup>9</sup> In order to conduct exploration, a developer must therefore sign a governmental contract or opt into a governmental administrative scheme.

In the United States, on the other hand, on-shore oil and gas rights may be owned privately before extraction. The fundamental principle that governs American oil and gas ownership is the “rule of capture,” which provides that a

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8. See *infra* notes 88, 92, 95 and accompanying text.

9. William T. Onorato & J. Jay Park, *World Petroleum Legislation: Frameworks that Foster Oil and Gas Development*, 39 ALTA. L. REV. 70, 73-74 (2001); Easo, *supra* note 3, at 27.

landowner owns any oil and gas extracted from a well drilled on her land.<sup>10</sup> The rule of capture is subject to various restrictions, including “conservation laws,” which set limits on the amounts of oil and gas that a landowner may lawfully capture on her land.<sup>11</sup> Approximately thirty percent of pre-extraction oil and gas in the United States is owned by government bodies; the rest is privately owned.<sup>12</sup> Thus, in the United States, developers may purchase the land (although not sea) they wish to explore. Alternatively, they may acquire exploration rights from private landowners.

### B. Contractual Arrangements

Oil and gas exploration and development require large amounts of capital and expertise. Therefore, whether oil and gas are publicly or privately owned, most exploration and development projects are carried out by large development companies.<sup>13</sup> The arrangements that govern these projects may be divided—roughly—into two major categories: leases (or licenses) and profit sharing agreements (PSAs).<sup>14</sup>

Leases grant developers ownership of any oil and gas to be extracted from a tract of land or sea over a certain period of time.<sup>15</sup> In the parlance of American oil and gas law, this right is initially known as the “mineral interest,” and when leased, it becomes the “leasehold interest.”<sup>16</sup> A lease may have a defined term of years, or it may run perpetually, for as long as oil and gas are produced.<sup>17</sup>

In return for mineral rights, developers pay landowners three typical types of payments: an initial “bonus”; periodic rental payments, which are ordinarily due only until extraction begins; and royalties, calculated as a share of the project’s oil and gas yield, if any, less production costs.<sup>18</sup> Oil royalties are often paid in kind.<sup>19</sup> In the United States, typical royalties range from 12.5% to 40% of production.<sup>20</sup>

Profit sharing agreements, on the other hand, do not grant the developer property rights in oil and gas. Under a PSA, the developer undertakes to explore and develop an area, usually at her own expense; any oil and gas to be extracted will be the property of the landowner (or sea-owner); and the landowner (or sea-owner) will be obligated to pay the developer a share of the oil and gas that are

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10. See, e.g., *Westmoreland & Cambria Nat. Gas Co. v. De Witt*, 18 A. 724, 725 (Pa. 1889); Robert E. Hardwicke, *The Rule of Capture and Its Implications as Applied to Oil and Gas*, 13 TEX. L. REV. 391, 392-93 (1935).

11. See, e.g., Bruce M. Kramer & Owen L. Anderson, *The Rule of Capture—An Oil and Gas Perspective*, 35 ENVTL. L. 899, 899-903 (2005).

12. LOWE, *supra* note 2, at 8. In Canada, oil and gas rights may, in theory, be privately owned, but this rarely occurs in practice. Alexander J. Black, *Comparative Licensing Aspects of Canadian and United Kingdom Petroleum Law*, 21 TEX. INT’L L.J. 471, 472 & n.1 (1986).

13. Easo, *supra* note 3, at 27.

14. See generally ANTHONY JENNINGS, *OIL AND GAS EXPLORATION CONTRACTS 2-3* (2d ed. 2008).

15. Easo, *supra* note 3, at 29-33; JENNINGS, *supra* note 14, at 2-10; ANDERSON ET AL., *supra* note 5, at 39-41.

16. LOWE, *supra* note 2, at 39-43.

17. *Id.* at 65.

18. ANDERSON ET AL., *supra* note 5, at 53-57; LOWE, *supra* note 2, at 278, 374-75.

19. ANDERSON ET AL., *supra* note 5, at 56; LOWE, *supra* note 2, at 279-80.

20. ANDERSON ET AL., *supra* note 5, at 57; LOWE, *supra* note 2, at 278-79.

extracted.<sup>21</sup> Typically, the developer's share diminishes once she has recovered her initial costs.<sup>22</sup>

Three additional regulatory models are worth mentioning, although they are less common. In the early twentieth century, government "concessions" granted developers *pre-extraction* ownership of oil and gas, usually over a large area and for a long period of time. In return, developers paid an initial sum and annual rent payments, but no share of production.<sup>23</sup> Another model is the "service contract," currently used in Iran and a handful of other countries. Under service contracts, developers perform exploration operations as contractors, in return for a fee. They sometimes bear the costs of exploration, and may receive a right to purchase oil and gas at discounted rates.<sup>24</sup> Finally, governments and developers may use jointly held corporations or other devices to carry out "joint ventures." Typically, the developer bears the costs of exploration in joint ventures. If exploration is successful, the parties share the costs and revenues of production.<sup>25</sup>

In the United States, the details of exploration and development agreements, which are most often leases, are highly individualized; John Lowe writes that "there are hundreds—or perhaps even thousands—of variations."<sup>26</sup> Common lease forms are sold by commercial publishers,<sup>27</sup> and several websites offer American landowners advice on how to negotiate their leases.<sup>28</sup> In contrast, where oil and gas are government-owned, developers do not usually have much sway over the terms of exploration agreements.<sup>29</sup> Lease terms are often statutory, in fact.<sup>30</sup> Nevertheless, courts tend to treat such arrangements as contractual.<sup>31</sup>

21. Easo, *supra* note 3, at 35-37; JENNINGS, *supra* note 14, at 2, 12-13.

22. JENNINGS, *supra* note 14, at 16; Emil M. Sunley et al., Revenue from the Oil and Gas Sector: Issues and Country Experience 7 (June 8, 2002) (unpublished manuscript), available at <http://siteresources.worldbank.org/INTTPA/Resources/SunleyPaper.pdf>.

23. Easo, *supra* note 3, at 33-35; JENNINGS, *supra* note 14, at 11; U.N. CTR. ON TRASNAT'L CORPS., ALTERNATIVE ARRANGEMENTS FOR PETROLEUM DEVELOPMENT 46-47 (1982). Today, some developing countries use instruments that are nominally concessions but virtually identical to leases. Easo, *supra* note 3, at 34; U.N. CTR. ON TRASNAT'L CORPS., *supra*, at 47-48.

24. Easo, *supra* note 3, at 37-39; JENNINGS, *supra* note 14, at 2, 20; U.N. CTR. ON TRASNAT'L CORPS., *supra* note 23, at 54-55.

25. U.N. CTR. ON TRASNAT'L CORPS., *supra* note 23, at 48-52. This U.N. manual is now thirty years old. I infer that the joint-venture model is uncommon today from the fact that it is not discussed by Easo, *supra* note 3, or by JENNINGS, *supra* note 14.

26. LOWE, *supra* note 2, at 65.

27. *Id.* at 64.

28. *E.g.*, OIL + GAS, <http://www.oil-gas-leases.com/index.html> (last visited Sept. 15, 2012); OIL & GAS MIN. SERVICES, <http://www.mineralweb.com> (last visited Sept. 15, 2012); *What Landowners Need to Know About Oil and Gas Wells*, N.Y. STATE DEP'T OF ENVTL. CONSERVATION, <http://www.dec.ny.gov/energy/1532.html> (last visited Sept. 15, 2012).

29. *See generally* Easo, *supra* note 3, at 29-34.

30. *Id.* at 30; JENNINGS, *supra* note 14, at 3 (discussing off-shore development in the United Kingdom).

31. Easo, *supra* note 3, at 30.

### C. Taxation

In the United States, revenue from oil and gas development is governed by the general principles of income taxation.<sup>32</sup> Specialized provisions do apply, however, as to how income is calculated.<sup>33</sup> In contrast, many other countries impose special taxes on oil and gas profits.<sup>34</sup> In the United Kingdom, for example, development projects approved before March 15, 1993 are subject to a 50% “petroleum revenue tax.”<sup>35</sup> Norway, too, imposes a 50% tax on oil and gas profits.<sup>36</sup> In Russia, special oil and gas taxes include several fees for subsoil use and a per-ton tax on mineral extraction.<sup>37</sup>

## III. HINDSIGHT REGULATION

This Part reviews behavioral scientific research on hindsight bias (Section A) and applications of this body of research to the law (Section B). To date, legal commentators have focused on the effects that hindsight bias can have on decisions made by judges and juries. Here, hindsight-bias analysis is extended to retroactive *regulation* (Section C). This framework will underpin Part IV’s examination of the hindsight-bias concern that arises in the exploration-regulation context.

### A. Hindsight Bias

“Hindsight bias” is the behavioral scientific label for the “truism that individuals often over-estimate, in retrospect, the likelihood that they would have predicted whatever outcome has occurred.”<sup>38</sup> This tendency, also known as the “knew-it-all-along effect,”<sup>39</sup> is reflected in expressions like “Monday morning quarterback” and in musings on human nature dating back to ancient times.<sup>40</sup>

Behavioral scientists have studied hindsight bias systematically since the 1970s. In a typical study, subjects are presented with factual scenarios and asked to estimate the probabilities of several possible outcomes; the estimates of subjects who were told that a certain outcome has, in fact, ensued are compared with the estimates of subjects given no such “outcome knowledge.” These studies have shown consistently that “finding out that an outcome has occurred increases its perceived likelihood” and that people “tend to believe that this

32. See generally LOWE, *supra* note 2, at 367-85.

33. See, e.g., 26 U.S.C. § 263(c) (2006) (allowing the deduction as expenses of intangible drilling and development costs). See ANDERSON ET AL., *supra* note 5, at 500-02 and *passim* for more detail on the peculiarities of oil and gas taxation.

34. See generally Sunley et al., *supra* note 22, at 6-7; Onorato & Park, *supra* note 9, at 79-81.

35. Easo, *supra* note 3, at 31.

36. *Id.* at 32.

37. *Id.* at 32-33.

38. Elaine Walster, ‘Second Guessing’ Important Events, 20 HUM. REL. 239, 249 (1967).

39. Jay J.J. Christensen-Szalanski & Cynthia Fobian Willham, *Hindsight Bias: A Meta-Analysis*, 48 ORG. BEHAV. & HUM. DECISION PROCESSES 147, 147 (1991); Gordon Wood, *The Knew-It-All-Along Effect*, 4 J. EXPERIMENTAL PSYCHOL.: HUM. PERCEPTION & PERFORMANCE 345 (1978).

40. Walster, *supra* note 38, at 239 (quoting Tacitus (56-117 A.D.)); see also Scott A. Hawkins & Reid Hastie, *Hindsight: Biased Judgments of Past Events After the Outcomes Are Known*, 107 PSYCHOL. BULL. 311, 323 (1990) (“Dramatic literature is replete with plots that appeal to people because of the sense of hindsight they invoke . . .”).

relative inevitability was largely apparent in foresight.”<sup>41</sup> Additional studies have identified another form of hindsight bias: knowledge about outcomes tends to distort a person’s recollection of her own ex ante probability estimates.<sup>42</sup> This form of bias, often termed “subjective” bias, has been found to be weaker than its so-called “objective” counterpart.<sup>43</sup>

In all, hundreds of experiments, conducted in many different contexts, have demonstrated that hindsight bias skews retrospective probability estimates.<sup>44</sup> Studies have also pointed to several factors that may influence the magnitude of hindsight bias. First, hindsight probability estimates are biased regarding both “positive” (happy) events and “negative” (unhappy) events; the bias is somewhat weaker, but still substantial, for “neutral” events.<sup>45</sup> Second, some studies have found that “events” produce a more powerful bias than “non-events.” In other words, retrospective estimates of event *X*’s probability will be skewed whether *X* did or did not occur; but the distortion caused by hindsight will be more dramatic (upward) if *X* occurred than it will be (downward) if *X* did not occur.<sup>46</sup> Third, some studies have found that professional expertise in the subject matter about which one is asked to estimate probabilities can decrease hindsight bias.<sup>47</sup> Finally, researchers have suggested that an event’s level of “surprisingness” might affect hindsight-bias magnitude. Research on this point has been inconclusive, however.<sup>48</sup>

### B. Legal Decision Making in Hindsight

Given that retrospective assessments of probability tend to be skewed, decisions that turn on such assessments are likely to be inaccurate.<sup>49</sup> This insight

41. Baruch Fischhoff, *Hindsight ≠ Foresight: The Effect of Outcome Knowledge on Judgment Under Uncertainty*, 1 J. EXPERIMENTAL PSYCHOL.: HUM. PERCEPTION & PERFORMANCE 288, 297 (1975); Hawkins & Hastie, *supra* note 40, at 311.

42. Baruch Fischhoff & Ruth Beyth, “I Knew It Would Happen”: *Remembered Probabilities of Once-Future Things*, 13 ORG. BEHAV. & HUM. PERFORMANCE 1, 13-15 (1975); Paul Slovic & Baruch Fischhoff, *On the Psychology of Experimental Surprises*, 3 J. EXPERIMENTAL PSYCHOL.: HUM. PERCEPTION & PERFORMANCE 544 (1977).

43. Rebecca L. Guilbault et al., *A Meta-Analysis of Research on Hindsight Bias*, 26 BASIC & APPLIED SOC. PSYCHOL. 103, 109-11 (2004). Guilbault et al. treat objective vs. subjective bias as another factor that affects bias magnitude. *Id.* at 105-06, 109-11.

44. A meta-analysis conducted in 1991 examined 40 hindsight-bias papers detailing 128 experiments. Christensen-Szalanski & Willham, *supra* note 39. Another, in 2004, looked at 95 papers detailing 307 experiments. Guilbault et al., *supra* note 43.

45. Guilbault et al., *supra* note 43, at 110-12.

46. Compare Christensen-Szalanski & Willham, *supra* note 39, at 154, 162 (more powerful bias for events), with Guilbault et al., *supra* note 43, at 100-11, 112-13 (no significant difference). This effect may be diminished, or even reversed, for unusually conspicuous non-events. Baruch Fischhoff et al., *Evolving Judgments of Terror Risks: Foresight, Hindsight, and Emotion*, 11 J. EXPERIMENTAL PSYCHOL.: APPLIED 124, 135-37 (2005). How a certain world-state is framed may influence whether it is perceived as an “event” or as a “non-event.” *Cf.*, e.g., Amos Tversky & Daniel Kahneman, *The Framing of Decisions and the Psychology of Choice*, 211 SCIENCE 453 (1981).

47. Christensen-Szalanski & Willham, *supra* note 39, at 151-52, 154, 162. *But see* Guilbault et al., *supra* note 43, at 112-13, 115.

48. Christensen-Szalanski & Willham, *supra* note 39, at 152; Guilbault et al., *supra* note 43, at 112.

49. Christensen-Szalanski & Willham, *supra* note 39, at 158-60, 164.

has stimulated a substantial body of legal scholarship.<sup>50</sup> In early legal hindsight-bias studies, subjects were asked to evaluate the reasonableness of measures taken by different kinds of decision makers: a psychotherapist who had some indications that a patient might turn violent,<sup>51</sup> or a municipality faced with a risk of flooding.<sup>52</sup> In each case, subjects equipped with the knowledge that unwanted outcomes had, in fact, occurred were markedly more likely to find that the real-time decision maker had taken insufficient precautions.<sup>53</sup>

Other studies have argued that hindsight bias confounds attempts to make retrospective judgments in various areas of the law. Such studies have looked at medical malpractice suits,<sup>54</sup> at negligence litigation more generally,<sup>55</sup> at *Bivens* actions,<sup>56</sup> and more.<sup>57</sup>

Some scholars have argued that the law has successfully developed several—limited—tools for reducing the effect of hindsight bias.<sup>58</sup> Thus, in corporate law, though not in ordinary tort settings, “the business judgment rule protects corporate officers and directors . . . because, in part, of the tendency for adverse outcomes to seem inevitable.”<sup>59</sup> Limitations on the courts’ after-the-fact review of decisions made by government officials<sup>60</sup> and defense attorneys<sup>61</sup> may also serve as correctives to hindsight bias. Additionally, courts tend to rely, where possible, on a “reliable ex ante assessment of reasonable care . . . such as custom in medical malpractice.”<sup>62</sup>

50. Anticipating legal scholars, behaviorists Scott Hawkins and Reid Hastie pointed to several legal implications of hindsight bias. Hawkins & Hastie, *supra* note 40, at 318.

51. Susan J. LaBine & Gary LaBine, *Determinations of Negligence and the Hindsight Bias*, 20 LAW & HUM. BEHAV. 501 (1996).

52. Kim A. Kamin & Jeffrey J. Rachlinski, *Ex Post ≠ Ex Ante: Determining Liability in Hindsight*, 19 LAW & HUM. BEHAV. 89 (1995).

53. LaBine & LaBine, *supra* note 51, at 511; Kamin & Rachlinski, *supra* note 52, at 99-101.

54. Hal R. Arkes & Cindy A. Schipani, *Medical Malpractice v. the Business Judgment Rule: Differences in Hindsight Bias*, 73 OR. L. REV. 587 (1994); Michael A. Haskel, *A Proposal for Addressing the Effects of Hindsight and Positive Outcome Biases in Medical Malpractice Cases*, 42 TORT TRIAL & INS. PRAC. L.J. 895 (2007).

55. Reid Hastie & W. Kip Viscusi, *What Juries Can't Do Well: The Jury's Performance as a Risk Manager*, 40 ARIZ. L. REV. 901 (1998); Kimberly Eberwine, Note, *Hindsight Bias and the Subsequent Remedial Measures Rule: Fixing the Feasibility Exception*, 55 CASE W. RES. L. REV. 633 (2005).

56. Peter Margulies, *Judging Myopia in Hindsight: Bivens Actions, National Security Decisions, and the Rule of Law*, 96 IOWA L. REV. 195 (2010).

57. See, e.g., Charles Yablon, *Hindsight, Regret, and Safe Harbors in Rule 11 Litigation*, 37 LOY. L.A. L. REV. 599, 621-32 (2004); Donald C. Langevoort, *The Epistemology of Corporate-Securities Lawyering: Beliefs, Biases and Organizational Behavior*, 63 BROOK. L. REV. 629, 661-62, 670 (1997); John C. Anderson et al., *The Presence of Hindsight Bias in Peer and Judicial Evaluation in Public Accounting Litigation*, 28 TORT & INS. L.J. 461 (1993); Gregory N. Mandel, *Patently Non-Obvious: Empirical Demonstration that the Hindsight Bias Renders Patent Decisions Irrational*, 67 OHIO ST. L.J. 1391 (2006).

58. Jeffrey J. Rachlinski, *A Positive Psychological Theory of Judging in Hindsight*, 65 U. CHI. L. REV. 571, 586-87, 603 (1998). Rachlinski argues, too, focusing on tort law, that even where hindsight bias has a powerful effect on legal decisions, it is not as harmful as we might fear. *Id.* at 596-600.

59. *Id.* at 574, 619-23; see also Arkes & Schipani, *supra* note 54, at 613-17; Haskel, *supra* note 54, at 925-26.

60. Margulies, *supra* note 56, at 218-20.

61. Stephanos Bibas, *The Psychology of Hindsight and After-the-Fact Review of Ineffective Assistance of Counsel*, 2004 UTAH L. REV. 1.

62. Rachlinski, *supra* note 58, at 574, 608-13; Arkes & Schipani, *supra* note 54, at 597-601; Haskel, *supra* note 54, at 916-21.



### C. *Retroactive Regulation in Hindsight*

Legal scholarship on hindsight bias has centered on judges' and juries' evaluations of a given event—an accident, a scientific discovery—after it has occurred. Such judgments generate a hindsight-bias problem if they turn on after-the-fact assessments of the event's probability. In contrast, hindsight-bias discussions have not looked closely at *regulation*. This is no accident. Much regulation does indeed turn on assessments of the likelihood of regulated events; but regulation typically addresses future actions, and thus does not turn on *retrospective* probability assessments.<sup>63</sup>

The assumption that regulation is basically forward-looking, and therefore not susceptible to hindsight bias, does not hold for *retroactive* regulation, however. Retroactivity is a subtle concept. A sizable body of scholarship has pointed to the difficulty of delineating its boundaries.<sup>64</sup> Here, I adopt a working definition from Stephen Munzer, according to which regulation is retroactive “if it alters the legal status of acts that were performed before it came into existence.”<sup>65</sup>

Retroactive regulation is a form of decision making about past events akin to courtroom judgments of negligence. When retroactive regulation turns on retrospective probability assessments, it will tend to be skewed by hindsight bias. The rest of this article will use the shorthand “hindsight regulation” to denote regulation that (1) is retroactive and (2) turns on a judgment of probability that (3) is skewed by hindsight bias. Each of these elements warrants clarification<sup>66</sup>:

(1) *Hindsight Regulation vs. Retroactive Regulation in General*. Hindsight regulation is a sub-category of retroactive regulation. Retroactive regulation generally—notwithstanding any hindsight-bias concerns—tends to undermine predictability and to frustrate expectations; it is therefore notoriously “not favored in the law.”<sup>67</sup> Different legal systems place varying constraints on the extent to which retroactive regulation is permissible.<sup>68</sup> Hindsight regulation shares the problems of retroactive regulation generally; in addition, it suffers the distorting effect of hindsight bias.

63. Jeffrey J. Rachlinski, *Regulating in Foresight Versus Judging Liability in Hindsight: The Case of Tobacco*, 33 GA. L. REV. 813, 814 (1999) (“A regulatory approach requires that an administrative body of some kind assess the dangers . . . before unwanted consequences occur.” (emphasis added)).

64. See, e.g., Stephen R. Munzer, *Retroactive Law*, 6 J. LEGAL STUD. 373 (1977); DANIEL E. TROY, *RETROACTIVE LEGISLATION* 4-9 (1998); Michael J. Graetz, *Legal Transitions: The Case of Retroactivity in Income Tax Revision*, 126 U. PA. L. REV. 47, 49-52 (1977).

65. Munzer, *supra* note 64, at 373.

66. My clarifications here are fairly abstract. For a more concrete example, see *infra* Part IV.

67. *Bowen v. Georgetown Univ. Hosp.*, 488 U.S. 204, 208 (1988); *Claridge Apartments Co. v. Comm’r*, 323 U.S. 141, 164 (1944).

68. In the United States, retroactive *criminal* legislation is constitutionally prohibited. U.S. CONST. art. 1, § 9, cl. 3 (prohibition on federal “ex post facto” laws); *id.* art. 1, § 10, cl. 1 (same for state laws); *Calder v. Bull*, 3 U.S. (3 Dall.) 386 (1798) (prohibition limited to criminal legislation). Additionally, American courts presume that legislation and administrative rules do not apply retroactively, *Union Pac. R.R. Co. v. Laramie Stock Yards Co.*, 231 U.S. 190, 199 (1913), and that administrative agencies are not authorized to promulgate retroactive rules, *Miller v. United States*, 294 U.S. 435, 439 (1935). These presumptions are rebuttable. *Usery v. Turner Elkhorn Mining Co.*, 428 U.S. 1, 16 (1976). Retroactive regulation may also bring the Takings Clause, U.S. CONST. amend. V, into play. See, e.g., Louis Kaplow, *An Economic Analysis of Legal Transitions*, 99 HARV. L. REV. 509, 563 (1986); Richard A. Epstein, *Beware of Legal Transitions: A Presumptive Vote for the Reliance Interest*, 13 J. CONTEMP. LEGAL ISSUES 69, 82-83 (2003).

(2) *Hindsight Regulation vs. Regulation Informed by Hindsight.* Innumerable decisions in various walks of life are *informed by hindsight*. Our decisions are grounded in our overall body of knowledge; some of our “information” is skewed by various cognitive biases, including hindsight bias. This difficulty is ubiquitous, and it is hard to conceive of a realistic effort to “solve” it. In contrast, the kind of hindsight decision making that is generally the focus of legal-policy discussions is more circumscribed. It involves normative decisions that are made *about* events after they have occurred, and that *turn on* retrospective assessments of the probability of these events. In such cases the hindsight-bias problem is front and center.<sup>69</sup> So, too, for the category of hindsight regulation discussed here, which is limited to regulation *about* a past event that *turns on* an estimate of that event’s probability.

(3) *Hindsight Regulation vs. Unbiased Retroactive, Probability-Based Regulation.* Hindsight *tends* to skew retrospective probability assessments. Some retrospective probability assessments, however—bucking this trend—will be correct. In other words, “sometimes . . . the person . . . really did ‘know’ it all along, i.e., would have acted the same without the hindsight information.”<sup>70</sup> By extension, retroactive regulation that turns on a retrospective probability assessment is not ipso facto faulty; its after-the-fact perspective notwithstanding, it may rest on an accurate probability assessment.

Assume, now, that a piece of post-event, retroactive, probability-based regulation has been proposed or enacted. Is there any way to determine whether or not this piece of regulation is tainted by hindsight bias? This is a difficult task, if only because an evaluation of regulation for hindsight bias is hindered by the same hindsight-bias problem that it seeks to investigate: this inquiry, too, must look at the probability of the regulated event after it has already occurred. Laboratory studies of hindsight bias determine whether a probability assessment is biased by comparing it to the “objective” assessments of subjects with no outcome knowledge. Evaluations of retroactive, probability-based regulation have no such objective assessments to rely on.

Or do they? One proxy for an objective probability assessment is, in fact, available: the scheme of *pre-event* regulation that is now up for amendment. This scheme of regulation represents a calculus of various factors, one of which, in our hypothetical, is a probability assessment. The pre-event regulatory scheme thus captures, among its other ingredients, the probability assessment that its enactors held before the regulated event occurred.

The enactment of retroactive post-event regulation means an implicit argument that the original scheme of regulation was flawed in some way. Now, perhaps an error can be identified in the original scheme that is unrelated to that scheme’s probability estimate. If not, however, the new regulatory regime embodies an implicit claim that the original regulation’s probability estimate was erroneous. This claim, made in hindsight, is suspect. Unless the regulator was incompetent or corrupt, the probability assessment underlying the pre-event scheme of regulation represents an objective, pre-outcome-knowledge assessment. The fact that this assessment appears inappropriate in hindsight is

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69. This is probably an over-simplification. But it does not seem feasible to worry about all decisions indirectly affected by inaccurate beliefs rooted in cognitive limitations.

70. Christensen-Szalanski & Willham, *supra* note 39, at 160.

likely attributable to hindsight bias. Similarly, this perceived inappropriateness is not, in itself, good evidence of pre-find incompetence or corruption.

In sum, retroactive, probability-based regulation is not *inherently* biased. It may be sound where pre-event regulation is flawed as far as an underlying factor unrelated to the regulation's probability assessment, or where independent factors point to ex ante regulatory incompetence or corruption. Otherwise, however, retroactive, probability-based regulation is likely biased hindsight regulation.<sup>71</sup>

#### IV. HINDSIGHT EXPLORATION REGULATION

This Part draws on the previous two to argue that hindsight regulation is a cause for concern in the context of oil and gas exploration. It begins with an account of the point of exploration regulation (Section A). This account underlies the Part's argument, first in the abstract (Section B) and then as applied to the real-world case of Israel's "Sheshinski Law" (Section C).

##### A. *The Point of Exploration Regulation*

What, then, is the point of exploration regulation? The account I offer here analyzes exploration regulation as an effort to achieve revenue maximization through revenue allocation. Before I expand on this idea, a few clarifications are in order. First, the "regulators" I have in mind here are both government officials and private contract-makers.<sup>72</sup> Both of these kinds of regulators, I assume, seek to maximize revenue—but while private actors maximize their own profits, government regulators generally, and ideally, attempt to maximize gains *to the public*. Finally, my depiction of the point of exploration regulation is a stylized model, intended to highlight the potential impact of hindsight bias on exploration regulation. Clearly, many factors that I ignore here—the quality of energy services, for example, or environmental consequences—play important roles in real-life situations.

Taken as a whole, a given regime of exploration regulation allocates portions of the expected revenue from exploration to the developer and to the regulator. This allocative decision serves as an exercise in revenue maximization<sup>73</sup>: regulators, including contract-makers, can be expected to use regulation to help maximize the revenue they hope to reap from exploration efforts.<sup>74</sup>

In order for regulation to achieve this goal, the developer's slice of the revenue pie must be calibrated carefully. An excessive developer share means an unnecessary sacrifice on the regulator's part. On the other hand, an

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71. Even under these conditions, this is not *certain*. It may be that the pre-event regulation represents an unusually poor probability assessment and that the post-event regulation represents unusually good bias-avoidance. This is just unlikely.

72. See *supra* note 7 and Section II.B.

73. Note that efficient allocation can also transfer resources to their more valuable uses and reduce deadweight bargaining costs. See, e.g., Gary D. Libecap, Chinatown: *Owens Valley and Western Water Reallocation—Getting the Record Straight and What It Means for Water Markets*, 83 TEX L. REV. 2055, 2089 (2005); Robert Cooter, *The Cost of Coase*, 11 J. LEGAL STUD. 1, 28 (1982).

74. Cf. U.N. CTR. ON TRANSNAT'L CORPS., *supra* note 23, at 7 (one objective of development policies is "securing maximum government revenue").

insufficient developer share will too often leave the regulator empty-handed. A developer will only undertake projects she deems commercially profitable. Each project's profitability is determined by three basic variables: the expected costs—including opportunity costs—of exploration; the probability of exploratory success; and the developer's cut of the profits should exploration prove successful. If the product of these last two variables (probability \* cut) does not outweigh the first (cost), the project will be grounded.<sup>75</sup>

The regulator will seek to maximize the value of her entire set of projects by allotting a measured share of the expected revenue to the developer. By reducing the developer's share, the regulator increases her own, but also decreases the number of projects that will get off the ground. Conversely, by boosting the developer's share, the regulator reduces her own, but also increases the number of projects that will be undertaken.<sup>76</sup>

This account of the point of exploration regulation may be reformulated in the language of "fair shares." This version of the story would replace the regulator's endeavor to maximize her revenue with an attempt to distribute the profits fairly, taking into account the contributions of land ownership, development efforts, and government sovereignty toward successful exploration. Here, as in other contexts, the substance and prescriptions of the idea of "fair shares" are rather elusive.<sup>77</sup>

### B. *The Worry*

Exploration regulation thus seeks to offer developers a level of incentives sufficient to entice them to undertake a good number of exploration projects. However, the sufficiency of any set of incentives will hinge on the probability of exploratory success.<sup>78</sup> Where success is comparatively likely, the regulator can set a relatively modest incentive level—thus increasing her share of the expected profits—without causing too many projects to be forgone. Where success is even more improbable than usual, the regulator will need to offer developers enhanced incentives—even though they diminish her own share of the pie—to maintain a satisfactory level of exploration.

Thus, exploration regulation must be founded on an estimate of the probability of exploratory success. As we have seen, probability estimates tend to diverge when made in foresight and in hindsight: hindsight exaggerates the probability of an outcome that has occurred in fact. Thus, if an exploration effort strikes oil, ex post estimates of that effort's ex ante prospects will be higher than objective estimates were in real time.

Hindsight bias in the context of successful exploration is likely to be formidable. The key hindsight bias in this situation is the more powerful,

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75. Cf. Easo, *supra* note 3, at 29 (the developer "will not be adequately motivated to explore a field efficiently unless it is entitled to an accepted level of benefit from discovery").

76. Sunley et al., *supra* note 22, at 1 ("the government will need to weigh its desire to maximize short-term revenue against any deterrent effects this may have on investment").

77. Cf., e.g., Graetz, *supra* note 64, at 73 (stating, vis-à-vis retroactive tax reforms, that "there exists no generally accepted test of fairness that one can apply"); LOUIS KAPLOW & STEVEN SHAVELL, *FAIRNESS VERSUS WELFARE* (2002) (questioning the intelligibility of "fairness" arguments generally).

78. Cf. M.A. Adelman, *The Real Oil Problem*, REGULATION, Spring 2004, at 16, 18 ("One cannot make a decision to drill and operate an oil well without a forecast of the well's production.").

“objective” variety: not a recollection by involved actors of their own pre-project assessments, but the biased postdictions of others, such as voters and politicians. The subject of postdiction is an event, not a non-event, and a “striking” one at that. Moreover, it is one about which the public, and to some extent its politicians, have little expertise.<sup>79</sup> These factors may contribute to the exaggeration of post-find probability assessments.<sup>80</sup>

A given exploration-regulation regime is likely to come under scrutiny in the wake of a major exploratory success. Post-find evaluations of the regime will draw on exaggerated estimates of the exploration project’s odds of success, or even on a sense that it was “known all along” that exploration would ultimately succeed. As a result, the regulatory scheme will seem overly generous: the incentives that it grants developers, considered in light of hindsight’s inflated view of the prospects of exploratory success, will appear to outstrip the incentive level that would have been necessary to encourage adequate exploration efforts.<sup>81</sup>

In short, even if exploration regulation was objectively reasonable *ex ante*, it will tend to seem overly generous toward developers post-find. This perception may provoke allegations of favoritism and distributive injustice, accompanied by demands that regulation be revamped. Such demands may form political pressure for the enactment of retroactive exploration regulation.<sup>82</sup> This pressure, especially if bolstered by supportive media coverage, may not easily be resisted by regulators.<sup>83</sup> To generalize, then, not only does hindsight bias hamper the quality of retroactive regulation that turns on probability assessments—it may also encourage the enactment of such regulation.

Assume, now, that pro-reform pressure is powerful enough to bring about some sort of change. Private landowners, who see their development agreements

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79. Hindsight bias might conceivably be mitigated by the availability of *ex ante* scientific reports on the likelihood of exploratory success. Cf. Fischhoff et al., *supra* note 46, at 137 (“people need explicit retrieved evidence of the sort produced by investigative committees”). However, it seems unlikely that the public or its politicians would be swayed by any such evidence offered post-find by wealthy—now wealthier—developers.

80. On the (arguable) significance of these factors, see *supra* text accompanying notes 45-48. Two additional characteristics of successful exploration are worth noting: it is a “surprising” event, and a “positive” one—at least for the developer. As noted *supra* text accompanying notes 45 and 48, however, these attributes have not been found to affect bias magnitude.

81. Post-find perceptions of regulation as gratuitously generous may be increased by another behavioral tendency: risk aversion. Research has shown that people “tend to be risk averse with respect to gains and risk seeking with respect to losses.” Tom Baker et al., *The Virtues of Uncertainty in Law*, 89 IOWA L. REV. 443, 453 (2004). Since the potential gains of exploration are very uncertain, developers may decline to take a project on unless it offers powerful monetary incentives. The reasonableness of this preference by ordinary-behavior standards might easily be overlooked post-find. On the other hand, risk aversion may be counteracted by optimism bias. Daniel Johnston, *Changing Fiscal Landscape*, 1 J. WORLD ENERGY L. & BUS. 31, 36 (2008).

82. On the dynamics of political processes of this sort, see generally JOHN W. KINGDON, *AGENDAS, ALTERNATIVES, AND PUBLIC POLICIES* (2d ed. 2003). For the role of public opinion, see *id.* at 65-67, 146-49. For that of the media, see *id.* at 57-61; Roberta Romano, *Does the Sarbanes-Oxley Act Have a Future?*, 26 YALE J. ON REG. 229, 255-58 (2009).

83. Regulators may be moved by countervailing forces as well. In particular, re-regulation may be detrimental to a regulator’s reputation, and may hamper her ability to commit credibly to future regulation. See *infra* note 89 and accompanying text. I would suggest, however, that the salience and immediate political bite of these concerns, cf. sources cited *supra* note 82, will be outweighed by those of the factors outlined in the text.

as unfair post-find, will not have much recourse. They may seek to renege on their contractual obligations, but these obligations will remain enforceable. Landowners might, however, push for new legislation to discharge their obligations.<sup>84</sup>

Government actors can do much more to rework the terms of exploration regulation. Legislation regarding ownership of oil and gas rights, developer payments, and taxation can be amended. Amended legislation can be structured, explicitly or implicitly, to apply to the exploration project or projects that prompted the reforms.<sup>85</sup> Even where the government is bound by contractual or semi-contractual arrangements, it has more leeway than private actors. First, in some jurisdictions, government bodies have the power to terminate contracts in light of substantial public interests or changes of political circumstances.<sup>86</sup> Moreover, even supposedly binding contracts can be difficult to enforce against recalcitrant governments.<sup>87</sup>

Hindsight exploration regulation would obviously be bad news for developers. A trickier question is whether it would be detrimental, more broadly speaking, as a matter of social utility and fairness. The chief advantages and disadvantages of post-find exploration re-regulation are those of retroactive regulation more generally.<sup>88</sup> In the exploration context, these factors play out roughly as follows:

As far as social utility, hindsight exploration regulation could offer a financial boost to the public (or, possibly, to individual landowners) at the expense of the developer, who is likely a wealthy corporation. Societies with an egalitarian bent may consider this to be a desirable redistributive result. On the other hand, re-regulation can entail longer-term costs. Once a regulator has disavowed her own regulation on one occasion, she will have trouble committing credibly to future regulation.<sup>89</sup> This will deter developers, as well as potential

84. In the United States, such legislation would probably have to be federal. U.S. CONST. art. 1, § 10, cl. 1.

85. Cf. TROY, *supra* note 64, at 7-9. Determining whether amendments to tax legislation should be considered retroactive can be particularly thorny. *Id.* at 4-6; Graetz, *supra* note 64, at 54-63. Israel's Sheshinski Committee, discussed *infra* Section IV.C, received memoranda from several prominent law professors on this issue. E.g., Memorandum from Barak Medina, Professor of Law, The Hebrew University of Jerusalem, to Eytan Sheshinski (July 18, 2010), available at <http://mof.gov.il/BudgetSite/Reform/Lists/List9/Attachments/27/barakMedina.pdf> (Hebrew); Memorandum from Joseph M. Edrei, Professor of Law, Haifa University, to Eytan Sheshinski (Sept. 7, 2010), available at <http://mof.gov.il/BudgetSite/Reform/Lists/List12/Attachments/1/980809.pdf> (Hebrew).

86. See, e.g., JENNINGS, *supra* note 14, at 12; Memorandum from Barak Medina, *supra* note 85, at 3.

87. See, e.g., JENNINGS, *supra* note 14, at 11-12.

88. See generally sources cited *supra* notes 64, 68; Symposium, *Legal Transitions: Is There an Ideal Way to Deal with the Non-Ideal World of Legal Change?*, 13 J. CONTEMP. LEGAL ISSUES 1 (2003). These studies focus on "meta-rules" regarding the chronological scope of legal changes. David M. Hasen, *Legal Transitions and the Problem of Reliance*, 1 COLUM. J. TAX L. 120, 137 (2010). This perspective calls into play considerations that are somewhat different from those entailed by an examination (like mine) of the effects of a particular legal change.

89. See, e.g., Kaplow, *supra* note 68, at 527, 575-76. For this argument in the context of Israel's Sheshinski Law, discussed *infra* Section IV.C, see, for example, Amiram Barkat, "Only an International Energy Giant Can Develop Israel's Gas Reserves," GLOBES (July 12, 2012), <http://www.globes.co.il/serveen/globes/docview.asp?did=1000765339&fid=1724> (stating that past re-regulation has scared off potential future investors). On the importance of credible commitments to contracting, see, for example, Anthony T. Kronman, *Contract Law and the State of Nature*, 1 J.L. ECON. &

business partners in other areas, from taking on future projects. These projects may therefore be forgone, or may have to be conducted by government bodies, or may cost the government extra “re-regulation premiums” as part of future developers’ compensation packages. The net effect of hindsight exploration regulation on social utility will therefore depend on a comparison between the value of immediate redistribution and that of lost benefits (or increased costs) in future transactions. If an exploration project is successful enough, and future prospects meager enough, the social utility of re-regulation may outweigh its costs.

Along fairness lines, the problem with re-regulation is its poor treatment of the developer. To re-regulate is, in essence, to back out of a commitment toward the developer after she has already borne the costs and risks of exploration.<sup>90</sup> This developer, moreover, represents not only a large, wealthy corporation, but also the sum of its individual—sometimes vulnerable—stock holders.<sup>91</sup>

The problem of unfairness toward developers may be lessened by pre-project precautions on the developer’s part: developers may take the risk of post-find re-regulation into account at the outset, by incorporating re-regulation premiums into their compensation packages.<sup>92</sup> The extent to which this form of self-insurance<sup>93</sup> will alleviate the fairness problem will depend, again, on the circumstances, and particularly on the ratio between the scope of re-regulation and the scope of the developer’s other projects.<sup>94</sup> To take an extreme example, if the entire range of a developer’s operations is re-regulated, self-insurance through increased benefit packages will not do much to diminish her injury or to eliminate the unfairness of re-regulation. And, while foresight and protective measures can diminish the harmful effects of an act—in this case, biased re-regulation—this does not make the act itself fair.<sup>95</sup>

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ORG. 5 (1985). Contract-oriented theories of credible commitment build on the work of Thomas Schelling, e.g., THOMAS C. SCHELLING, *THE STRATEGY OF CONFLICT* (1980).

90. Cf., e.g., Rachlinski, *supra* note 58, at 600-01; Black, *supra* note 12, at 488. For this argument in the context of Israel’s Sheshinski Law, discussed *infra* Section IV.C, see, for example, Yoav Dotan, *The Debate over Gas Royalties*, MAG. ECON. & SOC’Y PROGRAM (Mar. 14, 2011), <http://vanleerecon.wordpress.com/2011/03/14> (Hebrew).

91. See, in the context of Israel’s Sheshinski Law, discussed *infra* Section IV.C, Amiram Barkat, *The Gas-Oil Investors Go to War Against Sheshinski: Hired Attorney Ressler*, GLOBES (Nov. 16, 2010), <http://www.globes.co.il/news/article.aspx?did=1000601507> (Hebrew) (reporting a struggle against re-regulation by small-scale investors in Israeli oil and gas companies).

92. On market protections against legal change, see generally Kaplow, *supra* note 68; Louis Kaplow, *Transition Policy: A Conceptual Framework*, 13 J. CONTEMP. LEGAL ISSUES 161, 170 (2003).

93. In some contexts, third-party insurance against government expropriation may be available as well. RALPH H. FOLSOM ET AL., *INTERNATIONAL BUSINESS TRANSACTIONS IN A NUTSHELL* 275-80 (8th ed. 2009). I infer that this tack is not taken today (again, *supra* note 25) from the fact that it is not mentioned by Easo, *supra* note 3, or by JENNINGS, *supra* note 14. Note that if developers were to acquire third-party insurance, their re-regulation-based grievances would not evaporate, but rather would shift to their insurers.

94. Cf. Kaplow, *supra* note 68, at 546, 602-03.

95. The foreseeability of re-regulation also generates the more far-reaching argument that re-regulation is entirely fair—i.e., that reliance- or expectation-based fairness arguments against retroactivity are hopelessly circular. Graetz, *supra* note 64, at 73-79; Kaplow, *supra* note 68, at 522-25. To my mind, this generally forceful argument is substantially weaker in the kind of setting discussed here. First, the argument applies more readily to legal changes of general impact than to changes aimed at particular targets. Cf. Kaplow, *supra* note 68, at 544, 574-75, 605. Second, it applies more powerfully to legal *improvements*. *Id.* at 551; Kyle D. Logue, *Legal Transitions, Rational Expectations, and Legal Progress*, 13 J. CONTEMP. LEGAL ISSUES 211, 235-59 (2003). Biased re-regulation is hard pressed to meet this condition. See *infra* text before and after note 96.

In sum, post-find hindsight regulation will generally harm developers and their investors unfairly, although the degree of injury it causes will vary. Depending on the circumstances, re-regulation's net effect on society at large may be positive or negative.

Now, recall that *by hypothesis*, the post-find re-regulation we are now evaluating is hindsight-biased—i.e., it rests on a false evaluation of the ex ante prospects of exploratory success.<sup>96</sup> The presence of bias eats away at the potential social-utility merits of re-regulation. The probability of exploratory success is an integral component of the exploration-regulation calculus. When an erroneous perception of this element is plugged into the structure of information and policies that generates a scheme of regulation, this scheme will inevitably fail to strike the balance of objectives it was intended to achieve. Even if it does have a positive net social-utility effect, it will not be doing quite what it is supposed by its architects to be doing. In other words, hindsight exploration regulation is, to a degree, inherently unsound.

### C. A Case Study: Israel's "Sheshinski Law"

The last Section suggested that exploration regulation may be prone to undesirable post-find, hindsight bias-driven re-regulation. This worry should probably concern developers and regulators in the abstract. But it would be considerably more disquieting if hindsight exploration regulation were discernible in the real world. This Section looks at a recent story of public opinion-driven re-regulation of successful exploration projects, and suggests that hindsight bias may have played a part in this story.

In Israel, exploration is regulated primarily by the Petroleum Law of 1952.<sup>97</sup> The Petroleum Law requires that developers obtain government licenses before they begin exploration efforts.<sup>98</sup> If exploration is successful, the developer is entitled to a lease of thirty to fifty years.<sup>99</sup> The government's share of developed oil and gas is a 12.5% royalty, in kind or in value.<sup>100</sup> Other fees, including periodic rent payments, are generally marginal.<sup>101</sup> Additionally, a tax ordinance enacted in 1956 permitted developers to deduct a "depletion allowance" from their profits; in effect, this meant that up to 50% of oil and gas profits were tax free.<sup>102</sup>

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For a recent defense of reliance and expectation as arguments against (some forms of) retroactivity, see Hasen, *supra* note 88, at 155-70; cf. Epstein, *supra* note 68.

96. Again, it is not easy to judge if a given piece of re-regulation is indeed biased. I suggested earlier, *supra* text following note 71, that there is often good cause to suspect retroactive, probability-based regulation—like re-regulation of exploration—of bias. But in any case, at this juncture my argument is limited to *presumably* biased re-regulation.

97. Petroleum Law, 5712-1952, 6 LSI 129 (1951-1952).

98. *Id.* § 6. Licenses are granted in two stages: preliminary permits, *id.* §§ 7-12, which do not include drilling rights, and licenses, *id.* §§ 13-24, which do.

99. *Id.* §§ 26-31.

100. *Id.* § 32.

101. *Id.* §§ 7A(d), 15(a), 19, 42(1).

102. Income Tax Regulations (Deductions from the Income of Owners of Petroleum Rights), 5716-1956, § 3, KT 625, 1097.



For decades, exploration efforts in Israel fetched dismal results.<sup>103</sup> This changed dramatically in 2009, in a series of off-shore projects carried out by Texas-based Noble Energy and four Israeli energy companies. In January of 2009, large stores of gas were found at the Tamar gas field, fifty miles off the coast of Haifa.<sup>104</sup> In March, more gas was found, this time at nearby Dalit.<sup>105</sup> Tamar was the world's largest deep-water gas discovery in 2009.<sup>106</sup> It is estimated to hold nine trillion cubic feet of gas, and has been valued at \$4.55 billion.<sup>107</sup>

The successes at Tamar and Dalit “triggered a frenzy in [Israel’s] quiet energy industry.”<sup>108</sup> One consequence of this frenzy was the appointment, in April 2010, of a governmental committee charged with examining Israel’s policy on oil and gas revenue.<sup>109</sup> Eytan Sheshinski, a professor of economics at the Hebrew University, was named the committee’s chair.

The Sheshinski Committee was the subject of a raucous public debate.<sup>110</sup> Newspapers published countless editorials on whether Israel’s oil and gas regime should be reformed and whether such reforms should be applied to Tamar and Dalit.<sup>111</sup> One conspicuous, newly established non-profit, the Israel Civic Action

103. Charles Levinson, *For One Man, Israel’s Big Gas Find Is Bittersweet Victory*, WALL ST. J. (Nov. 30, 2009), <http://online.wsj.com/article/SB125955102831969055.html>. In 1999-2000, two modest-sized gas fields, Noa and Mari-B, were found off the coast of Ashkelon. *Energy & Infrastructure: Avner Oil & Exploration L.P., DELEK GRP.*, <http://www.delek-group.com/Holdings/EnergyInfrastructure/AvnerOilExploration.aspx> (last visited Sept. 15, 2012).

104. *Israel Discovers Huge Natural Gas Field*, OIL ISR. (Jan. 18, 2009), <http://www.oilinisrael.net/top-stories/israel-discovers-huge-natural-gas-field>; Peggy Williams, *Tamar Discovery Looms Large Offshore Israel*, E&P (Feb. 1, 2010), <http://www.epmag.com/Magazine/2010/2/item52335.php>.

105. Avi Bar-Eli, *Noble Energy Confirms: “Dalit”—A Natural Gas Discovery, High Quality Reservoir*, MARKER (Mar. 30, 2009), <http://www.themarket.com/markets/1.524570> (Hebrew).

106. Robin Beckwith, *Israel’s Gas Bonanza*, JPT, Mar. 2011, at 46, available at <http://www.spe.org/jpt/print/archives/2011/03/12Israel.pdf>; *What a Gas! Israel’s New Gas Finds May Affect Its Strategic Friendships Too*, ECONOMIST (Nov. 11, 2010), <http://www.economist.com/node/17468208>.

107. *Eastern Mediterranean*, NOBLE ENERGY, <http://www.nobleenergyinc.com/operations/international/eastern-mediterranean-128.html> (last visited Sept. 15, 2012); Avi Bar-Eli, *Tamar Offshore Field Promises Even More Gas than Expected*, HAARETZ (Aug. 12, 2009), <http://www.haaretz.com/print-edition/business/tamar-offshore-field-promises-even-more-gas-than-expected-1.281861>.

108. Levinson, *supra* note 103.

109. CONCLUSIONS OF THE COMMITTEE FOR THE EXAMINATION OF THE FISCAL POLICY WITH RESPECT TO OIL AND GAS RESOURCES IN ISRAEL 132 (2011), available at [http://www.financeisrael.mof.gov.il/FinanceIsrael/Docs/En/publications/02\\_Full\\_Report\\_Nonincluding\\_Appendixes.pdf](http://www.financeisrael.mof.gov.il/FinanceIsrael/Docs/En/publications/02_Full_Report_Nonincluding_Appendixes.pdf) [hereinafter SHESHINSKI REPORT] (the new gas finds are “at the heart of the Committee’s work”). The original (Hebrew) report is available at [http://mof.gov.il/BudgetSite/Reform/Lists/List11/Attachments/1/sheshinskiFullReport\\_n.pdf](http://mof.gov.il/BudgetSite/Reform/Lists/List11/Attachments/1/sheshinskiFullReport_n.pdf).

110. See, e.g., Ami Kaufman, *Reservoir Dogs: The Most Heated Debate in Israel You Probably Never Heard of*, +972 MAG. (Aug. 25, 2010), <http://972mag.com/reservoir-dogs-the-most-heated-debate-in-israel-you-probably-never-heard-of/1225>.

111. A small sample: Avi Bar-Eli & Motti Bassok, *Who Are the People Who Will Decide What Portion of the Gas that Was Found Will Go to the Public?*, MARKER (June 9, 2010), <http://www.themarket.com/markets/1.565504> (Hebrew); Avi Bar-Eli, *Five Spins of the Gas Companies*, MARKER (Nov. 10, 2010), <http://www.themarket.com/markets/1.591631> (Hebrew); Zvi Lavi, *Raising the Gas Royalties: Pressure on the Ministers After the Holidays*, YNET (Sept. 6, 2010), <http://www.ynet.co.il/articles/0,7340,L-3950489,00.html> (Hebrew); Einav Ratzon, *Not Stealing Natural Treasures: The Oil and Gas Exploration Companies Are Licensed*, NRG (Oct. 3, 2010), <http://www.nrg.co.il/online/16/ART2/162/471.html> (Hebrew).

Forum, promoted the position that “the proceeds from the natural gas recently discovered off Israel’s coastline can dramatically transform Israeli society. This is an historic opportunity. . . . However, there are those who wish to deprive the citizens of Israel of the tremendous potential offered by this natural resource.”<sup>112</sup> Many Israelis agreed.<sup>113</sup>

In June 2010, while the Sheshinski Committee was at work, another major discovery was announced. At Leviathan, about twenty-nine miles southwest of Tamar, Noble Energy and its partners found an estimated sixteen trillion cubic feet of gas, nearly twice as much as at Tamar.<sup>114</sup> Leviathan is believed to contain roughly 4.2 billion barrels of oil as well.<sup>115</sup>

The Sheshinski Committee published its final report in January 2011.<sup>116</sup> A statute enacting the committee’s recommendations, commonly known as the Sheshinski Law, was passed on April 10th.<sup>117</sup> The Sheshinski Law left the royalty rate intact, at 12.5%, but enacted a new oil and gas tax. This tax applies to a developer’s profits after she has recouped 150% of her exploration costs; the tax rate starts at 20%, and rises gradually to 50% as a project continues to generate revenue.<sup>118</sup> A new tax ordinance abolished the depletion allowance.<sup>119</sup> The new regulatory scheme applies to all current and future projects, including Tamar, Dalit, and Leviathan. Current projects are subject to discounted rates, however, for a transition period of several years.<sup>120</sup>

The story of the Sheshinski Law illustrates, first, what the *dynamics* of a process of hindsight exploration regulation might look like. Israeli exploration regulation was crafted with a view of the prospects of exploration—which were believed to be paltry—in mind.<sup>121</sup> In deciding whether to embark on exploration

112. ISRAEL CIVIC ACTION FORUM, <http://www.israel-restart.com/index.php?q=en> (last visited Sept. 15, 2012).

113. Compare, for a poll taken after the committee published its findings, Yossi Greenstein, *Ministry of Finance Poll: 80% of the Public Supports the Findings of the Sheshinski Committee*, NRG (Jan. 12, 2011), <http://www.nrg.co.il/online/16/ART2/199/598.html> (Hebrew).

114. Sivan Izasko & Lior Guttmann, *Now It’s Official: Leviathan Reservoir Has 453 Billion Cubic Meters of Natural Gas*, CALCALIST (Dec. 29, 2010), <http://www.calcalist.co.il/markets/articles/0,7340,L-3464961,00.html> (Hebrew); *Eastern Mediterranean*, *supra* note 107.

115. Neal Ungerleider, *Leviathan Gas Field Could Bring Catastrophe or Opportunity to Israel-Lebanon-Cyprus Borders*, FAST COMPANY (Dec. 29, 2010), <http://www.fastcompany.com/1713023/israel-cyprus-reach-agreement-on-leviathan-levant-basin-natural-gas-field-near-lebanon-and-g>.

116. SHESHINSKI REPORT, *supra* note 109. In November 2010, the committee published its preliminary findings. It then considered comments from the public before issuing its final, modified report. Guy Chazan, *Israel Sets Steep Rise in Taxes on Oil, Gas*, WALL ST. J. (Jan. 4, 2011), <http://online.wsj.com/article/SB10001424052748704835504576060041957275796.html>.

117. Petroleum Profits Taxation Law, 5771-2011, SH 2295, 806; Zvi Lavi, *The Sheshinski Law Is Passed by a Nearly Unanimous Knesset*, YNET (Mar. 30, 2011), <http://www.ynet.co.il/articles/0,7340,L-4049838,00.html> (Hebrew).

118. Petroleum Profits Taxation Law §§ 2-8, 20, 54.

119. Income Tax Regulations (Deductions from the Income of Owners of Petroleum Rights) (Amendment), 5771-2011, KT 6997, 938.

120. See also, e.g., Ethan Bronner, *Israel Approves Doubling of Taxes on Oil and Gas Extraction Profits*, N.Y. TIMES, Jan. 24, 2011, at A10.

121. Noble Energy and its Israeli partners stressed this argument in the memoranda they submitted to the committee. Memorandum from Agmon & Assocs., Law Firm, to the Committee to Examine the Fiscal Policy on Oil and Gas Resources in Israel (Aug. 25, 2010), available at <http://mof.gov.il/BudgetSite/Reform/Lists/List9/Attachments/39/novelEnergy.pdf> (Hebrew) (for Noble

off Israel's shore, Noble Energy and its partners surely took the odds of exploration into account. In fact, on the eve of the discovery of gas at Tamar, the project's chief architect and his business partner withdrew on account of the project's poor prospects.<sup>122</sup> Once gas was struck, however, the thrust of the public debate marginalized the projects' slim *ex ante* odds. Calls for retroactive reforms focused on how gas profits might be distributed most equitably—taking gas finds, in retrospect, as a foregone conclusion, rather than as the highly improbable prospect that they had represented *ex ante*.<sup>123</sup>

The questions of whether the Sheshinski Law itself—as distinct from the process of its enactment—is rooted in hindsight bias, and whether it is sound regulation, are, again, difficult ones. Earlier I argued, in the abstract, that post-event reforms of probability-based regulation are generally suspect for hindsight bias, with two exceptions: where a non-probability-related factor underlying the pre-event regulation is shown to be flawed, or where external evidence points to *ex ante* regulatory incompetence or corruption. No serious claims of incompetence or corruption arose in the context of the Sheshinski Law. As for non-probability-related flaws, the two major elements of the Sheshinski reforms appear to diverge, as follows<sup>124</sup>:

The repeal of the depletion allowance was defended stoutly on grounds of non-probability-related error. The Sheshinski Committee, echoing experts who opined before it,<sup>125</sup> argued that this deduction was transplanted inappropriately from the oil and gas regimes of the United States. Under the American system of private ownership, any oil and gas extracted represents a reduction of the value of the as-yet-unextracted oil and gas. Therefore, the American depletion allowance permits owners of oil and gas rights to deduct their lost value from their profits.<sup>126</sup> It makes little sense, however, to allow a developer to deduct a depletion allowance from her profits where the state—by definition—owns all pre-extraction rights.<sup>127</sup> This plausible argument suggests that the post-find repeal of the Israeli depletion allowance was not driven by hindsight bias.

The retroactive enactment of the new oil and gas tax is harder to defend on non-probability-related grounds. The new tax boils down to an “upgraded” distribution of oil and gas profits between developers and the government. No substantial argument was offered for the deficiency of the initial scheme of distribution, other than its apparent excessive generosity—as viewed post-find. The pre-find regulatory scheme should be taken to represent an objective *ex ante*

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Energy); Memorandum from Gornitzki & Co., Law Firm, to the Sheshinski Committee (Aug. 24, 2010), available at [http://mof.gov.il/BudgetSite/Reform/Lists/List9/Attachments/38/delek\\_1st.pdf](http://mof.gov.il/BudgetSite/Reform/Lists/List9/Attachments/38/delek_1st.pdf) (Hebrew) (for Delek Energy Systems, Inc., Delek Drilling, L.P., and Avner Oil Exploration, L.P.).

122. Levinson, *supra* note 103.

123. The Sheshinski Committee analyzes the *ex ante* odds of success at Dalit and Tamar, and concludes that these projects would have been undertaken under the new regime too. SHESHINSKI REPORT, *supra* note 109, at 140-42.

124. I recognize that the “elements” of regulation discussed here are of a slightly different sort than those invoked in the abstract model depicted *supra* text accompanying note 71. I suggest, tentatively, that the logic of the abstract model extends to distinctive doctrines like the depletion allowance.

125. See, e.g., Memorandum from Joseph M. Edrei, *supra* note 85, at 6-7.

126. ANDERSON ET AL., *supra* note 5, at 635-80; LOWE, *supra* note 2, at 370-73.

127. SHESHINSKI REPORT, *supra* note 109, at 62-63, 98.

assessment of the probability of exploratory success. Post-find, hindsight-aided criticisms of this scheme are therefore suspect.

Again, even assuming that the new oil and gas tax is hindsight-driven, it might entail a net gain in social utility; this would arguably depend on the scope of re-regulation's redistributive gains and on the scope of lost revenue, or increased costs, in future projects.<sup>128</sup> Several important factors in this vein were noted by the Sheshinski Committee. The committee writes that while the recent, re-regulated gas discoveries are extremely valuable, the scope of potential future discoveries may be even greater.<sup>129</sup> It also points to the growing role of gas in the Israeli and international economies.<sup>130</sup> Another key factor is the strategic importance of homegrown energy sources to Israel, given its hostile relations with many of the world's largest oil-producing nations. I have no guess as to the upshot of the social-utility calculus in the Sheshinski case. I do note again, however, that hindsight exploration regulation, even at its best, rests on an inherently flawed internal balance, and will therefore never quite hit its utility-oriented marks.

## V. EXPLORING FOR SOLUTIONS

This Part turns to a more constructive enterprise: the search for solutions to the worry developed in the previous Parts. It considers three approaches toward contending with this worry: treating it as an instance of sovereign risk (Section A); tackling regulators' hindsight bias (Section B); and adopting a regulatory model that is relatively bias-resistant (Section C).

### A. *Managing Sovereign Risk*

For developers, hindsight bias generates a specter of post-find re-regulation. This worry is fundamentally identical to the worry faced by everyone who does business with the government: the risk of sovereign expropriation.<sup>131</sup>

Hindsight bias may engender an especially insidious version of sovereign expropriation. Ordinarily, the confiscatory nature of expropriation is straightforward; at best, government takings are defended by reference to a redistributive agenda. Where hindsight bias is in play, however, regulators and their constituents may genuinely be blinded to the expropriation brought about by re-regulation.<sup>132</sup> The distortion caused by hindsight is likely to make re-regulation look like a justified correction of past regulatory mistakes. This will further hamper developers' already-difficult battle in the arena of public opinion.

There is no question that the concern over sovereign risk already plays a significant role in the design of exploration projects and agreements.<sup>133</sup> Jubilee Easo writes, for example, that developers "cannot ignore . . . the fact that [their] counterparty is a sovereign state and can, therefore, use a number of legal and

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128. For the latter factor, see Barkat, *supra* note 89.

129. SHESHINSKI REPORT, *supra* note 109, at 15-18.

130. *Id.* at 19-20.

131. Or, again—in the parlance of American law—Takings. See *supra* notes 7, 68.

132. Cf. Rachlinski, *supra* note 58, at 601-02 (hindsight causes biased judgments to seem fair).

133. In fact, in hindsight—after running through the argument of the preceding Parts—the worry over hindsight bias may itself seem self-evident. On this variety of hindsight bias, see Slovic & Fischhoff, *supra* note 42.

regulatory instruments to expropriate *de facto* entire fields or blocks, or reduce the revenue received by the [developer].”<sup>134</sup>

Developers’ hope to avoid post-find sovereign expropriation emerges in several forms. One is “stabilization clauses,” commonly included in production sharing agreements, which purport to shield the developer from future regulatory amendments.<sup>135</sup> Similarly, development contracts often provide that future disputes will be settled in international arbitration.<sup>136</sup> In a different vein, Anthony Jennings suggests that PSAs have become increasingly popular because they limit governments’ incentives to revisit development agreements—since under PSAs, governments retain ownership of all oil and gas.<sup>137</sup> Finally, as discussed above, developers may incorporate the risk of post-find expropriation into their exploration-related compensation packages.

These measures are by no means complete. Both stabilization clauses and arbitration clauses can be difficult to enforce.<sup>138</sup> PSAs, as well as joint ventures, may leave ownership of oil and gas in the government’s hands, but they do not necessarily reduce the government’s temptation to bite into the developer’s profits by changing tax rates or shares of production. And a developer’s ability to self-insure against expropriation will be limited by the scope of her development activities as a whole, as measured against the scope of a particular act of expropriation. Ultimately, developers are not fully protected, and “a certain amount of sovereign risk is unavoidable.”<sup>139</sup>

### B. Combating Hindsight Bias

Behavioral research has not unearthed an effective method for neutralizing hindsight bias. Researchers have attempted to reduce hindsight bias through the use of various cognitive and emotional manipulations, to little or no effect. In particular, hindsight bias is not “cured” in subjects who are—in principle—well aware of its perils.<sup>140</sup> It would therefore not do much good to point out to policy makers the probable effect of hindsight bias on their judgment. Once oil has been struck, an exaggerated perception of the likelihood of this occurrence will tend to endure.

At first blush, it might seem like a good idea to construct a general framework for post-find regulatory decision making, along the lines of the

134. Easo, *supra* note 3, at 28; JENNINGS, *supra* note 14, at 13; *cf.* Black, *supra* note 12, at 487-89 (discussing proposed re-regulation in the United Kingdom); YINKA OMOROGBE, *OIL AND GAS LAW IN NIGERIA* 181-82 (2003) (reviewing oil nationalization and citing cases); SHESHINSKI REPORT, *supra* note 109, at 147-49 (cataloguing recent changes to oil and gas regimes).

135. Easo, *supra* note 3, at 29, 37; JENNINGS, *supra* note 14, at 13, 17-18; U.N. CTR. ON TRANSNAT’L CORPS., *supra* note 23, at 41; Onorato & Park, *supra* note 9, at 100-11.

136. U.N. CTR. ON TRANSNAT’L CORPS., *supra* note 23, at 41; Mhairi Main Garcia, *Territorial Delimitation and Hydrocarbon Resources*, in *OIL AND GAS: A PRACTICAL HANDBOOK*, *supra* note 3, at 7, 9; JENNINGS, *supra* note 14, at 9, 12. *See generally* FOLSOM ET AL., *supra* note 93, at 322-28.

137. JENNINGS, *supra* note 14, at 12-13.

138. Easo, *supra* note 3, at 37 (“even when [stabilization] clauses exist, an extra issue is the extent to which they are enforceable”); JENNINGS, *supra* note 14, at 11-12 (arbitration clauses are often foiled); *id.* at 17-18 (same for stabilization clauses).

139. Easo, *supra* note 3, at 29; JENNINGS, *supra* note 14, at 13 (“nothing can be certain”).

140. Guilbault et al., *supra* note 43, at 110-11, 119; Hawkins & Hastie, *supra* note 40, at 314-16; Baruch Fischhoff, *Perceived Informativeness of Facts*, 3 J. EXPERIMENTAL PSYCHOL.: HUM. PERCEPTION & PERFORMANCE 349, 356-57 (1977).

business judgment rule.<sup>141</sup> We might want to instruct post-find regulators as follows: “Ignore the fact that the initial assessment of exploratory success now seems inappropriate. That done, is there good reason to think that pre-find regulation was rooted in non-probability-related error, in corruption, or in incompetence? If so, consider modifying it (taking countervailing considerations into account). Otherwise, do not re-regulate post-find.”

This tack would probably be futile as well, however. Even if such a guideline were made into law, legislatures, and by implication administrators with the legislature’s ear, would not be bound by it irreversibly. Post-find, facing pressure from constituents, it is unrealistic to expect regulators to reject their current (hindsight-biased) best judgments, and those of their constituents, in favor of the behavioral scientific insight that these judgments should not be trusted.

### C. *Choosing a Regulatory Model*

Regulators, too, might seek to avert the perils of hindsight exploration regulation. Two regulatory models seem relatively unsusceptible to the hindsight-bias problem.

One such model is that of the service contract. Hindsight bias-based post-find expropriation is not much of a concern in this model because there is not much to expropriate; the service-contract developer is not entitled to a significant share of development profits.<sup>142</sup> This model has powerful downsides, however, which presumably explain its unpopularity. Namely, it demands a large investment of government capital, and provides developers with weak incentives to conduct efficient exploration.<sup>143</sup> Both the advantages and the disadvantages of this model would hold in spades for exploration carried out by the government itself.<sup>144</sup>

Another model that seems relatively impervious to hindsight bias is the United States’ system of private ownership.<sup>145</sup> Under this model, the government’s involvement in development efforts is relatively minor: in most on-shore projects, its role is limited to taxation. It would therefore be more of a stretch for public sentiment, or public-policy entrepreneurs, to mobilize in favor of confiscatory re-regulation. Private landowners may well wish, post-find, to revisit the terms of exploration projects on their land, but they are effectively powerless to do so.<sup>146</sup> Furthermore, the decentralized nature of American oil and gas ownership fosters an environment in which oil and gas are not viewed as inherently public assets. Developers’ enjoyment of these assets is therefore less likely to engender resentment and an attendant push for re-regulation.

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141. See *supra* note 59 and accompanying text.

142. See *supra* note 24 and accompanying text.

143. Cf. U.N. CTR. ON TRANSNAT’L CORPS., *supra* note 23, at 56-57.

144. *Id.*

145. I offer anecdotal evidence of the American model’s advantage vis-à-vis hindsight bias-based expropriation. This article’s analysis of exploration regulation relies primarily on six works. Four are American books on American law, none of which mentions the risk of expropriation: LOWE, *supra* note 2; MARTIN & KRAMER, *supra* note 5; LOWE ET AL., *supra* note 5; and ANDERSON ET AL., *supra* note 5. The other two are comparative, transnational works by British authors; the risk of expropriation figures prominently in both: Easo, *supra* note 3, at 28-29, 34, 37; and JENNINGS, *supra* note 14, at 11-13, 17-18.

146. See *supra* text accompanying note 84.

Some, particularly in societies with egalitarian leanings, might see a downside in the fact that the private-ownership model takes control over development, and development profits (taxes aside), away from the public and its government.<sup>147</sup> Certainly not everyone will deem this a downside, however. Moreover, if a government were to decide to substitute private ownership for public ownership, it could, perhaps, do so by selling off its rights. Such sales would compensate the public for its forgone future gains in immediate revenue.<sup>148</sup>

One limitation of the private-ownership model is that, to date, it cannot apply to off-shore exploration—since the sea is publicly owned everywhere. This could, perhaps, change, someday. Moreover, off-shore oil and gas rights remain governmental in the United States too; and on American land, government bodies remain the largest owner of oil and gas rights.<sup>149</sup> These factors imply—if the case of the United States is as successful as I’ve been suggesting—that the recognition of *some* private ownership, even if it is limited in scope, may go a long way toward solving the problem of hindsight exploration regulation.<sup>150</sup>

The United States’ model of private oil and gas rights may also provide other benefits, unrelated to the hindsight-bias concern. In particular, private ownership tends to promote efficient resource management.<sup>151</sup> In the exploration context, resource management is generally carried out by non-owners. However, private owners crafting personalized contracts may do better than government bureaucracies and legislated semi-contracts at encouraging and monitoring efficient exploration.<sup>152</sup>

Finally, another factor altogether may explain why exploration re-regulation is less of a concern in the United States: the ubiquity of its oil and gas industry. The United States’ exploration-to-geographical-area ratio is the highest in the world.<sup>153</sup> Correspondingly, attitudes toward exploration seem to be somewhat more low-key in America than in other parts of the world. To Americans, the idea of “striking oil” represents a wonderfully successful investment, not a once-in-a-generation national opportunity.<sup>154</sup> American exploratory successes are

147. Under some circumstances, fragmented private ownership might also make efficient project sizes more difficult to achieve. Cf. Gary D. Libecap, *The Political Allocation of Mineral Rights: A Re-Evaluation of Teapot Dome*, 44 J. ECON. HIST. 381, 383-84, 388-91 (1984); Gary D. Libecap & James L. Smith, *The Economic Evolution of Petroleum Property Rights in the United States*, 31 J. LEGAL STUD. S589, S606-07 (2002).

148. Some concern might arise over the credibility of such sales: buyers might fear that their new rights may be revoked in the future. Cf. JENNINGS, *supra* note 14, at 11 (concessions granted, then rescinded).

149. See *supra* note 12 and accompanying text; Onorato & Park, *supra* note 9, at 73-74.

150. Cf. Black, *supra* note 12, at 472 (discussing limited private ownership in Canada); OMOROGBE, *supra* note 134, at 182-84 (noting the option of partial privatization in the Nigerian context).

151. See generally, e.g., Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. (PAPERS & PROC.) 347 (1967); DOUGLASS C. NORTH & ROBERT PAUL THOMAS, *THE RISE OF THE WESTERN WORLD: A NEW ECONOMIC HISTORY* (1973).

152. Cf. Onorato & Park, *supra* note 9, at 76-77 (oil and gas legislation should allow for contractual flexibility).

153. As the Sheshinski Committee noted. SHESHINSKI REPORT, *supra* note 109, at 40.

154. Consider, for example, that the Oilers are a National Hockey League team—albeit a Canadian one—and that the National Football League once had an Oilers team as well. Granted, the word “oiler” has several

consequently less provocative. This may mean some hindsight-bias diminution.<sup>155</sup> Even more importantly, it means that successful exploration is less likely to excite scrutiny of exploration regulation.

If this impressionistic account of the world of American exploration has some truth to it, the model of private ownership does not deserve full credit for the resistance of American oil and gas law to hindsight regulation. Then again, perhaps the prevalence and success of the American exploration industry are themselves due—to some degree—to the model of private ownership?

## VI. CONCLUSION

This article has offered arguments on several levels of generality. In roughly descending measures of abstraction, they run as follows: First, hindsight bias may encourage, and skew, retroactive regulation. Second, where retroactive regulation turns on a judgment of probability, it is suspect—with certain exceptions—for hindsight bias. Third, retroactive *exploration* regulation, if affected by hindsight, is generally unfair and unsound (although perhaps, sometimes, accompanied by a net gain in social welfare). Fourth, the United States' system of private oil and gas rights, or a variation on it, may offer the best available means of overcoming the hindsight-bias problem. Fifth, certain portions of Israel's recent post-find adjustments to its exploration-regulation regime are likely unfair, flawed hindsight regulation.

I conclude with a brief return to the broadest of these arguments. Hindsight bias may bring about skewed retroactive regulation not only with regard to oil and gas exploration, but also in other areas in which regulation turns on judgments of probability. Two other examples of such areas, which have both been conspicuous in recent years, come to mind: regulation of environmentally dangerous activities, and regulation of financial institutions. Regulation of environmentally dangerous activities turns on an estimate of the probability of environmental catastrophe. Regulation of financial institutions turns on an estimate of the probability of economic collapse. In both cases, in hindsight, disaster tends to seem almost inevitable, and regulatory standards inexcusably lax.<sup>156</sup> Each of these contexts is thus susceptible to hindsight regulation: in each, the public and its regulators may be misled by hindsight bias into enacting unfair, unsound retroactive regulation.<sup>157</sup>

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meanings. And the logo of the NHL's Edmonton Oilers is not clearly exploration-related. That of the NFL's Houston Oilers, on the other hand, was singularly suggestive of exploration as an ongoing pursuit:



Edmonton



Houston

155. *Cf. supra* note 46.

156. *Cf., e.g.,* Roberta Romano, *The Sarbanes-Oxley Act and the Making of Quack Corporate Governance*, 114 *YALE L.J.* 1521, 1591-94 (2005) (stating that financial regulation tends to be enacted in the wake of financial disasters); Michael Barsa & David A. Dana, *Reconceptualizing NEPA to Avoid the Next Preventable Disaster*, 38 *B.C. ENVTL. AFF. L. REV.* 219, 226, 242 (2011) (discussing proposed reforms in the wake of the *Deepwater Horizon* oil spill—"a risk that, in hindsight, seems clearly like it should have been considered").

157. Note that I refer here neither to misguided (e.g., over-reactive) prospective regulation—although it too may be a concern—nor to unbiased retroactive regulation. *See supra* Section III.C.



The primary implications of this article's hindsight-bias perspective on regulation, for these cases and others, are rather gloomy: hindsight regulation is not a good idea, but it is not easily forestalled.