OFFICE OF INFORMATION AND REGULATORY AFFAIRS

Key Methodological Considerations in Regulatory Impact Analysis: A Case Study Approach

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Methodological Case Study: Regulatory Response to Deepwater Horizon Event

- In response to the BP Deepwater Horizon explosion and resulting oil spill, the Secretary of the Interior produced a report on steps to improve the safety of offshore oil and gas drilling in Federal Waters

- This regulation implements key recommendations identified in this report

- Not all recommended measures were implemented

- The regulatory impact analysis associated with the regulation helped inform which measures were justified from a cost benefit perspective

Identification of the Problem

- Extensive regulation of offshore drilling prior to the Deepwater Horizon Oil Spill
  - Outdated, did not account for changing, complex operational conditions
  - Insufficient protection of the environment and those conducting operations under certain conditions

Identification of the Problem

- Uncertainty associated with *ex post* compensation for natural resource damages and other consumer and producer surplus losses
  - Uncertainty about the ultimate scope and magnitude of natural resource damages associated with a large offshore spill suggests an *ex ante,* preventative approach.
- Information Asymmetries: Ex Post compensation regime for natural resource damages provides little information to regulators regarding the effectiveness of safe operating incentives embodied in the regulation.
  - Ex ante regime provides society with greater transparency and assurance that safety measures on operations perform as expected
- Market distortions: statutory liability limits for operators creates potential to avoid liability by declaring bankruptcy – operators may take undue risks and cost cutting measures absent explicit requirements

Options

- Additional safety measures to reduce frequency of a catastrophic oil spill and severity of its impact (through a shorter period of discharge)
- 30 day Safety Report to the President identified four items for emergency regulation:

1) **Develop secondary control system requirements**
2) Establish new blind-shear ram redundancy requirements
3) **Establish new deepwater well control requirements**
4) Adopt safety case requirements for floating drilling operations on the OCS

Conceptual Framework

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- Benefit Cost Analysis
- Estimate costs of compliance associated with new regulatory provisions
- Estimate benefits utilizing consumer surplus measures to characterize avoided cost impacts on recreation and producer surplus measures to estimate avoided costs to industry.
- Scenario Analysis used to assess when expected benefits should justify expected costs
- Implemented Methodologies
  - ✓ Contingent Valuation
  - ✓ Benefit Transfer Method
- Decision Criteria
  - ✓ Sensitivity Analysis
  - ✓ Break Even analysis

Impact Evaluation

- Benefit Cost Analysis
- Estimate costs of compliance associated with new regulatory provisions
- Estimate benefits utilizing consumer surplus measures to characterize avoided cost impacts on recreation, and producer surplus measures to estimate avoided costs to industry
- Scenario Analysis used to assess when expected benefits should justify expected costs

Regulatory Alternatives

- Baseline Scenario: status quo – no additional regulatory measures
- Exempt small businesses
- Delay implementation timelines to comply with the regulation

Costs

- Industry compliance costs associated with installing new hardware and well completion procedures:

1) Use of dual mechanical barriers in addition to cement barriers to prevent hydrocarbon flow in the event of failure
2) Application of pressure testing procedures to production casing strings
3) Maintenance of standby ROV capability

- $183 million/year annually
- Estimates based on public data, confidential information from industry

Summary of Annual Recurring Costs

Regulation	Recurring Costs:	MODU Wells (112/yr)	Fixed Platforms (48/yr)	Shallow Wells (186/yr)	Cost Shares
		Total ($MM)	Total ($MM)	Total ($MM)	
250.449(j)(k)	Subsea ROV function testing (drilling)	102.7	0.0	0.0	***56%***
250.516(d)(8), 250.616(h)(1)	Subsea ROV function testing (workover/completions)	15.5	0.0	0.0	***8%***
250.423(c)	Test casing strings for proper installation	32.1	6.0	7.0	***25%***
250.420(b)(3)	Installation of dual mechanical barriers	4.4	1.4	4.5	***6%***
250.420(a)(6)	PE certification for well design	1.3	0.5	4.2	***3%***
250.451(i)(j)	Emergency cost of activated shear rams or LMRP disconnect	2.6	0.0	0.0	***1%***
250.416(e)	Independent third party shear certification	0.4	0.2	0.6	***1%***
	Estimated Cost per year:	**158.8**	**8.1**	**16.3**	**$ 183.1**
	Estimated Cost per well:	**1.42**	**0.17**	**0.09**	

Benefits

- Avoided costs associated with reduction in expected natural resource damages resulting from reduced likelihood of system failure
- Avoided cost is approximation of “true” benefits of avoiding a catastrophic spill
- Avoided Private-Social Costs
- Avoided External Social Costs
- Benefits transfer approach: estimates economic value by transferring existing benefits calculations from studies already completed for another location or issue to the case at hand (ongoing litigation).

Avoided Private-Social Costs

Private-Social Cost	Estimated Value
Damage/loss of Drilling Rig	338,000,000
Well Containment, 120 days	1,466,666,667
Lost Crude Oil, 4.77 million barrels	333,900,000
Lost Natural Gas, 6.92 million MMBtu	27,666,000
Total:	**$2,166,232,667**

Avoided External-Social Costs

Social Cost Category	Cost	Avoided Cost for 1 Hypothetical Spill
	($ per bbl)	(4.8 mm bbl)
Natural Resource Damages	$604	$2.88 billion
Recreational Losses (Recreational Fishing and Beach Recreation)	$42	$0.20 billion
Commercial Fishing Losses	$2	$0.01 billion
Value of Life and Nonfatal Injury	$13	$0.06 billion
Other Health Effects	Not Quantified	
Oil Spill Response & Damage Assessment Costs	$2,300	$10.97 billion
Staging, training, and other costs associated with prepositioning oil spill response assets	Not Quantified	
Price effects in seafood markets	Not Quantified	
Property values	Not Quantified	
TOTAL		**$14.12 billion**

Scenario Analysis

- Baseline assumptions
  - Characterize recent Gulf of Mexico deepwater oil and gas activity levels and historical rate of events up to including April 20th blowout
  - Historical: Since 1973 a blowout resulting in catastrophic spill among 4,123 wells drilled
  - Future: 160 wells drilled annually over next 20 years
  - Baseline probability of catastrophic blowout: 1 every 26 years (4123/160)
  - 3.85% chance of spill in any given year

Summary of Private and External Social Costs

Social Cost Category	**Conditional Avoided Cost Amount**	**Expected Avoided Cost Given 1 Spill in 25.8 years (3.85% probability of a spill each year)**
Private Costs	$ 2.17 billion	$84.1 million
External Costs	$14.12 billion	$547.3 million
Total:	**$16.29 billion**	**$631.4 million**

Benefits

- Avoided costs associated with reduction in expected natural resource damages resulting from reduced likelihood of system failure
- Avoided cost is approximation of “true” benefits of avoiding a catastrophic spill
- Benefits transfer approach: estimates economic value by transferring existing benefits calculations from studies already completed for another location or issue to the case at hand (ongoing litigation).
- Total avoided cost estimate: $16.3 billion includes private social and external social costs

Benefits

- Derived from detailed cleanup estimates using damage costs per barrel measures found in historical spill data and from aggregate damage measures contained in legal settlement documents for past spills applied to catastrophic spill of hypothetical size
- Avoided private costs for containment operations
- Three components account for avoided spill costs:

1) Natural resource damage to habitat and creatures
2) Infrastructure salvage and cleanup operations
3) Containment and well plugging actions plus lost hydrocarbons

Benefits

- Uncertainty: reflects only those outlays calculated based on factors derived from past spills or cited by operators as costs
- Possible losses from human health effects of reduced property values have not been quantified
- Actual time needed to carefully assess spill’s full social costs may be years
- Probability of future blowout leading to catastrophic spill is difficult to quantify

Baseline

- No Action: State of the world pre-intervention
- Characterization of recent Gulf of Mexico deepwater oil and gas activity levels and historical rate of events up to and including April 20th blowout
- Historical: Since 1973 1 blowout resulting in catastrophic spill among 4,123 wells drilled
- Future: 160 wells drilled annually over next 20 yrs
- Characterization of baseline size and duration of catastrophic spill: 53,000 barrels/day for 90 days: 4.77 million barrels -- $32 billion total.

Scenario Analysis/Break Even Analysis

- Regulation can affect both size of possible future spill and frequency
- Vary these parameters under reasonable assumptions to compare various alternative scenarios
- Vary cost assumptions over expected spill interval to estimate break even outcomes

Scenario Analysis

- Under what scenarios would benefits justify costs?
- Baseline probability of catastrophic blowout: 1 every 26 years (4123/160)
- 3.85% chance of spill in any given year
- Regulation can affect both size of possible future spill and frequency
- Vary these parameters under reasonable assumptions to compare various alternative scenarios
- Vary cost assumptions over expected spill interval to estimate break even outcomes

Sensitivity Analysis

1) The avoided social costs are varied by about plus 100% and minus 50%, reflecting alternative spill sizes and scope as discussed in the next section, resulting in a higher ($32.2B) and lower ($11.1B) avoided cost factor.
2) The compliance costs are lowered by about 50% to $97 million reflecting productivity improvements, and raised by about 100% to $352 million reflecting more frequent compliance problems and work stoppages during drilling operations, as discussed in the next section.
3) The population of deepwater wells subject to a future catastrophic blowout spill is limited to those in water deeper than 3,000 feet, where the spill size and consequences (but not the spill probability) from a blowout are estimated to be greater. For the purpose of conducting this sensitivity analysis only, we employed the historical population of 1,475 wells drilled in the GOM at a water depth of 3000 feet or greater to set the baseline risk, and forecast that an average of 110 wells will be drilled each year at this depth.

Breakeven Sensitivity Calculations (Base)

	Base Case		Wells Drilled	Wells Drilled per Year	Years per Major Spill	Chance of Major Spill per Year	**$ billions**
	Historical Wells Drilled >500'		4123	160	25.8	3.9%	
Base Case, Historical Wells Drilled > 500'	**Benefit Case:**	**Low**	Major Spill Avoided Cost:		$11.1	Annual Spill Cost:	$0.4
	Compliance Cost Case		Reduced Spill Cost for Breakeven	Years Without Event to Breakeven	Wells Drilled Without Event to Breakeven	New Probability of Catastrophic Event	Required Reliability Increase
	Low	$0.097	$0.3	33.2	5,317	3.0%	**22%**
	Base	$0.183	$0.2	44.8	7,168	2.2%	**42%**
	High	$0.352	$0.1	140.9	22,551	0.7%	**82%**
	Benefit Case:	**Base**	Major Spill Avoided Cost:		$16.3	Annual Spill Cost:	$0.6
	Compliance Cost Case		Reduced Spill Cost for Breakeven	Years Without Event to Breakeven	Wells Drilled Without Event to Breakeven	New Probability of Catastrophic Event	Required Reliability Increase
	Low	$0.097	$0.5	30.4	4,867	3.3%	**15%**
	Base	$0.183	$0.4	36.3	5,801	2.8%	**29%**
	High	$0.352	$0.3	58.1	9,296	1.7%	**56%**
	Benefit Case:	**High**	Major Spill Avoided Cost:		$32.2	Annual Spill Cost:	$1.2
	Compliance Cost Case		Reduced Spill Cost for Breakeven	Years Without Event to Breakeven	Wells Drilled Without Event to Breakeven	New Probability of Catastrophic Event	Required Reliability Increase
	Low	$0.097	$1.2	27.9	4,469	3.6%	**8%**
	Base	$0.183	$1.1	30.2	4,830	3.3%	**15%**
	High	$0.352	$0.9	35.9	5,740	2.8%	**28%**

Break Even Sensitivity Calculations (Alternate)

	Alternate Case		Wells Drilled	Wells Drilled per Year	Years per Major Spill	Chance of Major Spill Per Year	$ billions
	Historical Wells Drilled >3000'		1475	110	13.4	7.5%	
Alternate Case, Historical Wells Drilled > 3000'	**Benefit Case:**	**Low**	Major Spill Avoided Cost:		$11.1	Annual Spill Cost:	$0.8
	Compliance Cost Case		Reduced Spill Cost for Breakeven	Years Without Event to Breakeven	Wells Drilled Without Event to Breakeven	New Probability of Catastrophic Event	Required Reliability Increase
	Low	$0.097	$0.7	15.2	1,670	6.6%	**11.7%**
	Base	$0.183	$0.6	17.2	1,894	5.8%	**22.1%**
	High	$0.352	$0.5	23.3	2,566	4.3%	**42.5%**
	Benefit Case:	**Base**	Major Spill Avoided Cost:		$16.3	Annual Spill Cost:	$1.2
	Compliance Cost Case		Reduced Spill Cost for Breakeven	Years Without Event to Breakeven	Wells Drilled Without Event to Breakeven	New Probability of Catastrophic Event	Required Reliability Increase
	Low	$0.097	$1.1	14.6	1,602	6.9%	**8.0%**
	Base	$0.183	$1.0	15.8	1,736	6.3%	**15.1%**
	High	$0.352	$0.9	18.9	2,076	5.3%	**29.0%**
	Benefit Case:	**High**	Major Spill Avoided Cost:		$32.2	Annual Spill Cost:	$2.4
	Compliance Cost Case		Reduced Spill Cost for Breakeven	Years Without Event to Breakeven	Wells Drilled Without Event to Breakeven	New Probability of Catastrophic Event	Required Reliability Increase
	Low	$0.097	$2.3	14.0	1,537	7.2%	**4.0%**
	Base	$0.183	$2.2	14.5	1,597	6.9%	**7.6%**
	High	$0.352	$2.0	15.7	1,728	6.4%	**14.7%**

Assumptions

- Timing uncertainty addressed by assuming that spills equally likely to occur in any one year – avoids arbitrary timing specifications
- Coincident timing of compliance costs and risked avoided costs avoids need to complicate analysis with discounted present value amounts

Conclusion

- An example of how to illustrate plausible impacts given scarce availability of data
- If unable to adequately monetize true impacts, use benefit transfer approach to approximate likely scenarios
- A metric for decision making but important to understand limitations, make assumptions clear and caveat appropriately