Measuring the Impact of High Oil Prices and Federal Policy Initiatives in Offshore Gulf of Mexico Exploration, Development and Production Activity

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Overview

• Modeling objectives
• IIC EDP Model
• Resource inputs
• High oil and gas prices
• Alternative royalty initiatives
• Future research/applications
• Conclusion/Acknowledgements
IIC EDP Model Objectives

- Developed for Minerals Management Service
  - Assist Resource and Evaluation, and Economics Divisions
  - EIS, Leasing Programs, Policy Analysis
- Ties economics to traditional discovery, production processes
  - Projects future exploration, development and production activity at a field-level
- Specific to Offshore Gulf of Mexico
  - Allows user-defined geographic boundaries
    - Current project: 21 “areas”
      - 3 planning areas (CGM, WGM, EGM)
      - 7 water depth categories (0-60, 60-200, 200-400, 400-800, 800-1600, 1600-2400, 2400+ meters)
- Easily applicable to other global offshore regions
IIC EDP Model Schematic

Lease Sale

Constraints:
Leasing Policy
Rig Availability
Resource Assessment

Production from Existing Reserves

Discovery model: 
\( f(x) \) of NPV, 
exploratory 
wells, resource base 
and drilling history

NPV/Production Model: 
expected value simulation to 
trigger production lag 
between discovery, 
development and production

Production Function: 
Based on Historical 
Production Data by 
Field Size and Location

Outputs:
Exploratory Wells
Field Discoveries
Reserves
Production
Infrastructure
Fiscal Variables

Inventory of New Proven Fields

Inputs:
Prices
Costs
Field Characteristics
Reserve Growth
Policy Variables

Production from New Reserves
Field-Level Economics

• Two primary uses
  – Decision making process of when and where to explore (drill) for resources
  – Development process: field feasibility

• Discounted cash flow (DCF) net present value (NPV) component
  – Annual cycle of computing the economic value of developing and producing newly discovered fields
  – Performed for all fields by
    • Area (planning area and water depth category)
    • Field size (USGS Classification): Defined by the range (mmBOE) $0.03125 \times 2^{(n-1)}$ through $0.03125 \times 2^n$, where $n = \text{field size}$

• How do prices/royalty policy affect field-level economics?
  – Revenue component: (Price * Production) – Taxes – Royalties
Field-Level Economics

Net Present Value for Field Class 8 in CGM 800-1600m Water Depth

DWRRA (87.5 mmBOE)

No Relief

Price ($/ Bbl)

NPV ($ million)

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Exploratory Well Drilling

- Initial step in process
  - Exploratory wells discover new fields
  - IIC defined “E” wells

- Developed exploratory well equations
  - Function of net present value of discovered fields and expected discoveries
  - Assumption that oil and gas companies react to possibility of future profitable discovery and value of past discoveries
  - Historic exploratory well drilling fit using an optimization procedure
    - Using multiple years to fit – not limited to one year
Exploratory Well Drilling

Exploratory Well Fitting, Central GOM 200-400m

- Model Fit
- Actual Wells

Exploratory Wells

Discovery, Development and Production

- **Exploratory wells find new fields**
- **Development decision based on field-specific NPV**
  - Field feasible with positive NPV
  - Restraints and lags
- **Production**
  - \[ P_t = \beta \times (R_{E_{t-1}} + R_{A_t} - C_{P_{t-1}}) \]
  - \( \beta \) = production coefficient (historic modeling)
  - \( R_{E_{t-1}} \) = Reserve estimate last year
  - \( R_{A_t} \) = Reserves added this year (MMS appreciation)
  - \( C_{P_{t-1}} \) = Cumulative production through last year
  - Dependent on in-field drilling to maximize RA
  - Production wells take precedence over exploration wells
Forecast Period and Resource Inputs

• Model forecast period: 2003-2042
  – Data limitations
  – Model calibration

• Resource distributions
  – Undiscovered Resources
  – Discovered Resources

• Price Scenarios
  – Reference case: $30/bbl and $4.54/mcf
  – Static high price case: $45/bbl and $6.81/mcf
  – High spike price case: to $70/bbl in model year 3 (2005), followed by a decline to reference case
  – All scenarios assume a 12 percent discount rate, 35 percent tax rate
### Summary of Impacts Under Different Price Scenarios

<table>
<thead>
<tr>
<th></th>
<th>Reference</th>
<th>High Static</th>
<th>High Spike</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exploratory Wells Drilled</td>
<td>7,607</td>
<td>9,837</td>
<td>8,195</td>
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<tr>
<td>% Increase From Reference</td>
<td></td>
<td>29.3%</td>
<td>7.7%</td>
</tr>
<tr>
<td>Fields Discovered</td>
<td>672</td>
<td>792</td>
<td>704</td>
</tr>
<tr>
<td>% Increase From Reference</td>
<td></td>
<td>17.9%</td>
<td>4.7%</td>
</tr>
<tr>
<td>Reserves Discovered (mmBOE)</td>
<td>49,005</td>
<td>57,137</td>
<td>51,263</td>
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<tr>
<td>% Increase From Reference</td>
<td></td>
<td>16.6%</td>
<td>4.6%</td>
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<tr>
<td>Oil Production from Forecasted Discoveries (mmBOE)</td>
<td>16,356</td>
<td>20,383</td>
<td>18,577</td>
</tr>
<tr>
<td>% Increase From Reference</td>
<td></td>
<td>24.6%</td>
<td>13.6%</td>
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<tr>
<td>Gas Production from Forecasted Discoveries (Bcf)</td>
<td>96,521</td>
<td>117,065</td>
<td>107,675</td>
</tr>
<tr>
<td>% Increase From Reference</td>
<td></td>
<td>21.3%</td>
<td>11.6%</td>
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*Cumulative Impacts to 2042*
Price Forecast Results

GoM Discovered Fields
(All Sizes, All Areas)

# of Fields Discovered


Reference
High Static
Alternative Royalty Initiatives

• Applied on annual lease sales beginning in 2003
• **Deepwater Royalty Relief Act (DWRRA)**
  – Field-level suspension volumes
    – 200-400 meters: 17.5 mmBOE
    – 400-800 meters: 52.5 mmBOE
    – 800 meters and greater: 87.5 mmBOE
• **“Current” DWRR program**
  – Lease-based suspension volumes
    – 400-800 meters: 5 mmBOE
    – 800-1600 meters: 9 mmBOE
    – 1600 meters and greater: 12 mmBOE
• **No future relief**
# Alternative Royalty Initiatives Results

## Summary of Impacts Under Different Deepwater Royalty Relief Programs

<table>
<thead>
<tr>
<th>Royalty Regime</th>
<th>Grown Reserves Discovered (mmBOE)</th>
<th>Total Production from New Discoveries (mmBOE)</th>
<th>Present Value Total Royalty Revenue from New Discoveries ($ millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original DWRR</td>
<td>49,005</td>
<td>33,531</td>
<td>$16,114</td>
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<tr>
<td>% Change from No Relief</td>
<td>2.1%</td>
<td>2.5%</td>
<td>-17.7%</td>
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<td>Current DWRR</td>
<td>48,692</td>
<td>33,281</td>
<td>$17,504</td>
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<tr>
<td>% Change from No Relief</td>
<td>1.4%</td>
<td>1.8%</td>
<td>-10.6%</td>
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<tr>
<td>No Relief</td>
<td>47,999</td>
<td>32,706</td>
<td>$19,580</td>
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</tbody>
</table>

*Cumulative Impacts to 2042*
Future Research and Other Applications

- Sustained high prices ($60-$70 per barrel)
  - NPV concerns with historical fits
  - Re-calibration of model algorithms depending on drilling/discovery events (2003-2007)

- Deep gas initiatives
  - Shallow water initiatives
  - How to segregate “areas” (drilling depth)?

- Use Lease Distributions
  - Expand set “lag” for royalty initiatives

- Global expansion
  - Assist government agencies in looking at Offshore regions
  - Tailor to specific oil company areas, expectations
Conclusions and Acknowledgements

• High resource prices (oil and gas)
  – Lead to increase in expected exploration activity
  – Higher field feasibility – increased production

• Price shock
  – Leads to a “bump” in exploration, development, production activity
  – In reality, dependent on expectations?

• Royalty Initiatives
  – Stimulate exploration, development, production activity
  – Trade-off in reserves discovered and royalty revenue
  – Helps the marginal fields achieve profitability

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