Team - License to Drill (John Shaddix, Chris Wolf, Ben Beyer, Jake Stroud, Sudamsh Reddy)

UT Energy Symposium

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**Case Overview**

**Time line:**
- 1985 – Retter started an exploration program in Fruktania
- 1994 – Oil discovered by Retter
- 1996 – Civil war in Fruktania, Retter to declare force majeure and evacuate all expatriate staff
- 2010 – End of civil war but fragile government

**Case objective**

**Data given:**
- Expected exploration and production costs with time
- Expected production of oil and gas with time

**Objective**
- What is the NPV of this project?
## Valuation methods

### Project valuation methodologies

<table>
<thead>
<tr>
<th>Method 1</th>
<th>Deterministic NPV model using expected values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Using most likely values for production volumes, oil prices and capital and operating expenses</td>
</tr>
<tr>
<td></td>
<td>• Use a higher discount factor to take into account the impact of expropriation</td>
</tr>
<tr>
<td></td>
<td>• It is simple to calculate but not very insightful</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method 2</th>
<th>Monte Carlo Simulation on production and costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Use distributions to capture the uncertainty in production volumes, oil prices and capital and operating expenses</td>
</tr>
<tr>
<td></td>
<td>• Use a higher discount factor to take into account the impact of expropriation</td>
</tr>
<tr>
<td></td>
<td>• Does not take into account the extreme cases of expropriation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 3</th>
<th>Monte Carlo with Embed Force Majeure Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Use distributions to capture the uncertainty in production volumes, oil prices and capital and operating expenses</td>
</tr>
<tr>
<td></td>
<td>• Include Force Majeure Risk: Probability of a pre-mature termination of project because of expropriation / political instability</td>
</tr>
<tr>
<td></td>
<td>• Better model to capture the risk involved</td>
</tr>
</tbody>
</table>
## Valuation methods

### Method 1: Deterministic NPV

**Forecast Assumptions**

- Use most likely values for:
  - Future oil production
  - Future crude oil price
  - Future operating expense
  - Future capital expense

**Valuation Model**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Production (MMBbls)</td>
<td>67</td>
<td>68</td>
<td>68</td>
<td>68</td>
<td>65</td>
</tr>
<tr>
<td>Crude Oil ($/Bbl)</td>
<td>$83.81</td>
<td>$85.07</td>
<td>$86.43</td>
<td>$87.89</td>
<td>$89.44</td>
</tr>
<tr>
<td>Gross Revenue</td>
<td>$5,598</td>
<td>$5,775</td>
<td>$5,868</td>
<td>$5,967</td>
<td>$5,778</td>
</tr>
<tr>
<td>Less: Royalty</td>
<td>(1,400)</td>
<td>(1,444)</td>
<td>(1,467)</td>
<td>(1,492)</td>
<td>(1,444)</td>
</tr>
<tr>
<td>Net Revenue</td>
<td>$4,199</td>
<td>$4,331</td>
<td>$4,401</td>
<td>$4,475</td>
<td>$4,333</td>
</tr>
<tr>
<td>Less: Operating Costs</td>
<td>(349)</td>
<td>(359)</td>
<td>(366)</td>
<td>(374)</td>
<td>(372)</td>
</tr>
<tr>
<td>Less: Depreciation</td>
<td>(1,703)</td>
<td>(1,788)</td>
<td>(1,838)</td>
<td>(1,880)</td>
<td>(1,826)</td>
</tr>
<tr>
<td>EBIT</td>
<td>$2,146</td>
<td>$2,185</td>
<td>$2,197</td>
<td>$2,221</td>
<td>$2,135</td>
</tr>
<tr>
<td>Less: Taxes</td>
<td>(966)</td>
<td>(983)</td>
<td>(989)</td>
<td>(1,000)</td>
<td>(961)</td>
</tr>
<tr>
<td>Un-levered Net Income</td>
<td>$1,180</td>
<td>$1,201</td>
<td>$1,208</td>
<td>$1,222</td>
<td>$1,175</td>
</tr>
<tr>
<td>Plus: Depreciation</td>
<td>1,703</td>
<td>1,788</td>
<td>1,838</td>
<td>1,880</td>
<td>1,826</td>
</tr>
<tr>
<td>Less: CAPEX</td>
<td>(400)</td>
<td>(800)</td>
<td>(720)</td>
<td>(640)</td>
<td>(480)</td>
</tr>
<tr>
<td>Change in NWC</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Free Cash Flow</td>
<td>$1,303</td>
<td>$988</td>
<td>$1,118</td>
<td>$1,240</td>
<td>$1,346</td>
</tr>
</tbody>
</table>

| Discount Factor       | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 |

**NPV** $33.8
Method 2: Monte Carlo simulation for NPV

Forecast Assumptions

Use distribution values for
- Future oil production
- Future crude oil price
- Future operating expense
- Future capital expense

Run iterations and get NPV distribution instead of a single NPV value

Distributions for inputs

Output NPV distribution

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Method 3: Monte Carlo simulation with Force Majeure risk for NPV

Forecast Assumptions

Use distribution values for
• Future oil production
• Future crude oil price
• Future operating expense
• Future capital expense
• Probability of Force Majeure

Run iterations and get NPV distribution instead of a single NPV value

Output NPV distribution

<table>
<thead>
<tr>
<th></th>
<th>Y1</th>
<th>Y2</th>
<th>Y3</th>
<th>Y4</th>
<th>Y5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of expropriation</td>
<td>5%</td>
<td>5%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Scenario 1</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>
Project Valuation

Risk-Adjusted Cash Flows Approach

Step 1
Construct Basic Operating Model
- Flexible operating model to capture project fundamentals and discrete effects of relevant variables
- Free cash flows evaluated deterministically for reasonableness

Step 2
Monte Carlo Simulation
- Commodity price risk → Mean reverting Brent crude price forecast
- Production uncertainty → +/- % Via distribution of outcomes
- Capital cost uncertainty → +/- % Via distribution of outcomes

Step 3
Embed Force Majeure Risk
- Force Majeure Risk: Probability of a pre-mature termination of project
- Annual schedule for percent (%) probability of early termination
- Probability highest in 2012, declines to steady-state for life of project
Mean Reverting Price Forecast
Captures Commodity Price Volatility and Market Forces

Forecast Assumptions

**Long Run Price - $80/Bbl**
- Annual historical data produced $75/Bbl
- Recent macro forces indicate future LRP of $80/Bbl
- Price escalation at 2%

**Historical Volatility**
- $15.70 (18%) according to annual historical data

**Mean Reversion Speed**
- 0.20 according to annual historical data

Source: Energy Information Agency (EIA) annual Brent Crude prices
Mean Reverting Price Forecast
Captures Commodity Price Volatility and Market Forces

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Source: Energy Information Agency (EIA) annual Brent Crude prices
Risk-Adjusted Cash Flows Approach

**Valuation Methodology:**

<table>
<thead>
<tr>
<th>NPV and IRR</th>
<th>Base Case</th>
<th>Risk-Adjusted Base Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,659 MM / 17%</td>
<td>$837 MM / 15%</td>
<td></td>
</tr>
<tr>
<td>Social Investment Program</td>
<td>Fruktania Proposal</td>
<td>Fruktania Proposal</td>
</tr>
</tbody>
</table>
Negative Impact of Expropriation Risk on Base Case Valuation

Project Valuation Assumptions

Oil Price:
• Mean Reverting Model, Long-Run Price: $80/Bbl

Production: (-10%) / +5%

Capital cost: (-10%) / +10%

#2 – Fruktanian Proposal

Force Majeure Risk:
2012: 7.5%
2013: 5%
2014+: 2%

Social Investment:
2011- 2015: $25 MM
2016 – 2034: $5 MM

Retter Corp. lacks control of fund distribution

Project valuation must account for substantial geopolitical risk – Retter Social Investment Program can mitigate risk of force majeure

Oil Price:
• Mean Reverting Model, Long-Run Price: $80/Bbl

Production: (-10%) / +5%

Capital cost: (-10%) / +10%

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Force Majeure Risk:
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Net Present Value (NPV) Impact

Base Case: $1,659
R.A. Base Case: $837
NPV Change: ($822)

Project Lifetime Force Majeure Probability

Base Case: 0%
R.A. Base Case: 43%

<table>
<thead>
<tr>
<th>Value x 10^-4</th>
<th>Base Case</th>
<th>R.A. Base Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>-$5,441</td>
<td>-$5,441</td>
</tr>
<tr>
<td>Max</td>
<td>$9,034</td>
<td>$8,315</td>
</tr>
<tr>
<td>Mean</td>
<td>$1,659</td>
<td>$837</td>
</tr>
<tr>
<td>Stdev</td>
<td>$1,758</td>
<td>$2,092</td>
</tr>
</tbody>
</table>
Sensitivity Analysis

Base Case

- Includes Fruktania proposal for social investment
- Does not incorporate Force Majeure Risk

Key Results

- Breakeven Crude Oil Price: $75/Bbl 15% IRR
- Project Delay Effect: 1 Yr. Delay NPV decrease $201MM

Project Valuation

Value Drivers for Project Economics

Relative Effect (+/- % of NPV) from Change in Key Inputs

- Crude Oil Price (10%) / 10%
- Production Volume (10%) / 5%
- FEED Costs (10%) / 10%
- Development Well Costs (10%) / 10%
- Operating Costs (10%) / 10%
- One Year Project Delay (1 year) / na

Price and production uncertainties have tremendous impact on project value
Conclusion

Key takeaways

Oil price forecasting - Mean reverting model

Expropriation risk – Probability distribution in Monte Carlo simulation

Sensitivity analysis to identify key variables and reduce their uncertainty
Thank You