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Recognizing the Value of Real Options

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The economic fortunes of oil and gas exploration and production (E&P) companies are tied to commodity prices, which can be volatile and cyclical, as shown in Exhibit 1. Thus, it is not surprising that the outlook for oil and gas prices plays a pivotal role in the valuation of these companies, both in and out of the bankruptcy context.

When oil and gas prices are high and are expected to remain high, the E&P companies enjoy high earnings and high valuations. Higher commodity prices increase the amount of revenue generated from their production and increase the amount of oil and gas reserves that are economic to produce. However, the opposite is true in situations when commodity prices are expected to be low. During these low-commodity price environments, E&P companies can face liquidity issues and pursue restructuring under chapter 11. For example, the COVID-19 pandemic and the resulting global reduction in demand and commodity prices resulted in a wave of E&P bankruptcies in 2020 on more than $50 billion of associated liabilities.

During a bankruptcy and restructuring, creditor recoveries and solvency claims are closely tied to the debtor's valuation. An unsecured creditor may either be positioned to receive significant recovery and upside potential upon emergence, or have the value of its claim be fully impaired depending on the accepted valuation of the enterprise. Therefore, valuations from various interested parties involved in the bankruptcy proceeding are often heavily scrutinized and fiercely contested.

Valuation Methodologies

There are multiple methodologies to value a company, but they generally fall into three categories. First, there are market-based approaches such as analyses of precedent transactions or comparable companies, which utilize market transactions or trading data (*e.g.*, multiples from recent acquisitions or based on the value of other publicly traded companies) to arrive at a valuation. However, selecting the appropriate set of transactions or comparable companies in the oil and gas industry can be challenging given the different operating characteristics and geographical footprints. Even if the transactions/companies have assets in similar locations, reserves within the same geological formations can sometimes have different qualities that meaningfully influence the economics.

The second category of valuation methodologies is the income-based approach. It typically involves a discounted-cash-flow analysis (DCF) whereby the cash flows for the company are projected out for a number of years (*e.g.*, five to 10 years) and are discounted using an appropriate discount rate to arrive at a net-present value of these expected cash flows. This figure is then added to the terminal value, which represents the company's remaining value for the period after the projection ends.

There are several ways that terminal value can be calculated. One approach is to assume that the company's cash flow grows in perpetuity at a set growth rate, while another method is to use a multiple of earnings before interest, taxes, depreciation and amortization. Each of the assumptions and inputs into the DCF valuation — cash-flow projections, discount rate and terminal value — is an area of expert judgment and should be carefully considered. For example, given that oil and gas are finite resources, an assumption of perpetual growth should be scrutinized in the case of an E&P company valuation.

The third category is the asset-based approach. Under this category, net-asset-value (NAV) techniques that measure the value of the company's assets are frequently utilized in valuations of E&P companies. Since oil and gas reserves are an E&P company's primary assets, the NAV measures the value of these reserves, which are classified into various categories based on the likelihood or probability of successful development and extraction.

The reserves that are currently producing are classified as "proved developed-producing." "Probable" reserves have a greater than 50 percent likelihood of successful extraction/recovery. At the end of the spectrum, the unproved reserves that have a probability of successful extraction/recovery between 10-50 percent are classified as "possible" reserves.[1] The amount of a company's reserves and where those reserves land across the classifications can change based on commodity price expectations.

1 "Petroleum Reserves Definitions," Soc'y of Petroleum Eng'rs, *available at* spe.org/en/industry/petroleum-reserves-definitions (unless otherwise specified, all links in this article were last visited on July 25, 2024).

Higher commodity prices can increase the likelihood of the reserves being developed and included in drilling plans, while lower commodity prices can cause reserves to be removed from management's drilling plans and end up in a lower reserve tier. Under the NAV method, the reserves are "risked" using either the risk-adjusted-discount-rates method, whereby the projected cash flows from each reserve classification are discounted using their own unique discount rate (with higher discount rates for reserves with a lower likelihood of recovery), or reserve-adjustment factors, whereby the projected cash flows are risk-adjusted based on the reserve classification and the adjusted cash flows are discounted using a single discount rate.[2]

The income- and asset-based approaches can be particularly sensitive to the specific commodity price forecast being relied on. Projections of oil and gas prices inform the cash-flow projections for the DCF valuation. Given the importance that expected prices have on management's drilling plans and expected production, even slight changes in expected prices (when those prices are near break-even economic levels) can have large impacts on cash-flow projections. The price forecasts also affect the reserve classifications and the value of the companies' oil and gas reserves under the NAV approach.

E&P valuations both in and outside of U.S. bankruptcy courts have utilized futures prices from the New York Mercantile Exchange (NYMEX). A commodity futures contract refers to the future purchase or sale of a commodity at a price that is agreed on today. Oil and gas futures contracts are offered monthly and will specify the volume, type or quality of the commodity, and the specific delivery location.

Oil futures are traded separately from natural gas futures. West Texas Intermediate (WTI) crude oil is one of the principal crude oil futures contracts traded on NYMEX. Natural gas for delivery at the Henry Hub is one of the main natural gas futures contracts traded on NYMEX.

These oil and gas futures prices, particularly for the upcoming two years, are based on actual trading and thus offer valuable information regarding the market's price

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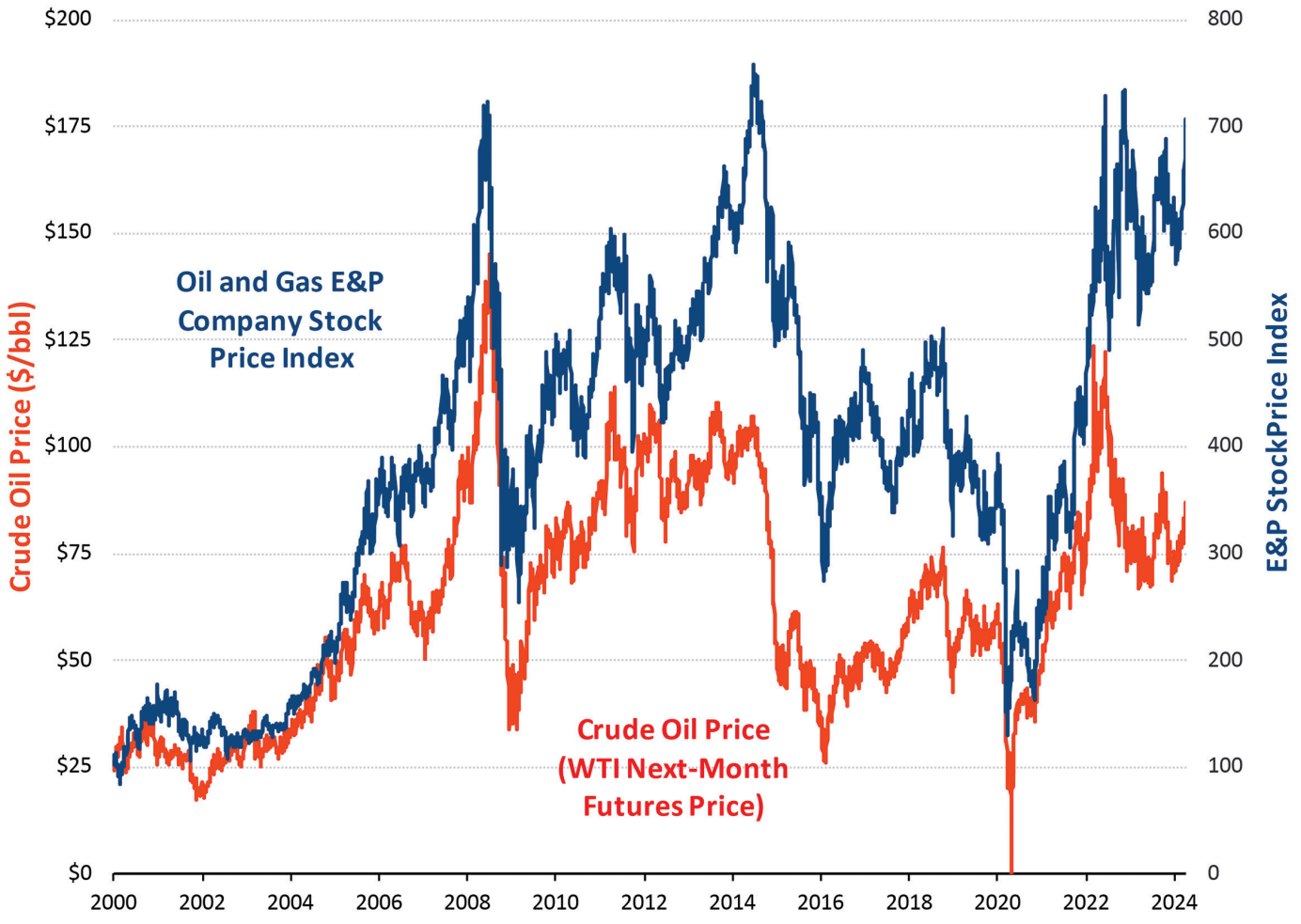
2 The Society of Petroleum Evaluation Engineers (SPEE) publishes results of its annual survey reporting these values. An example of the range of risk-adjusted discount rates from SPEE 2018 is found in 2018 SPEE Result Survey Results reported in Bureau of Ocean Energy Management Gulf of Mexico Data and Analysis/Leasing, Drilling and Production: Gulf of Mexico Shallow Water Potential Stranded Assets, Exhibit A, p. 12.

Exhibit 1: E&P Asset Values Follow Energy Prices



Sources: "NYMEX Futures Prices", Crude Oil Contract 1, U.S. Energy Information Administration; S&P 500 Oil & Gas Exploration & Production Index, through April 5, 2024.

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expectations.[3] It is reasonable to use these futures prices for valuation purposes. However, a sole reliance on NYMEX futures (which has historically been mandated in the bankruptcy courts), without regard to the volatility and uncertainty surrounding these prices and the optionality this creates for E&P companies, could lead to meaningful undervaluation.

There could be a high degree of uncertainty about future oil and gas prices. This uncertainty is reflected, for example, in the short-term oil price outlook prepared each month by the EIA.[4] This short-term energy outlook includes low- and high-price projections at a 95 percent confidence interval — meaning a 95 percent likelihood that the actual prices would be within that range. As of July 2024, the EIA estimated a range of projections for WTI oil prices just one year in the future between $50 to $120 per barrel.[5] In short, while the NYMEX futures prices contain recent market transactions, there could be significant uncertainty surrounding those prices.

This uncertainty can have economic significance in determining whether certain E&P projects are worthwhile to pursue. Certain reserves may be uneconomic to develop at $50-per-barrel oil prices. Management may then exclude them from drilling plans used to develop the cash-flow projections, implying that those reserves will not contribute to incremental cash flows at those price levels.

However, developing those reserves might be a profitable endeavor at higher oil prices that could reasonably be expected to occur. Management has the option and flexibility to wait and develop these reserves under higher-priced outlooks. Like any financial choice, this real option carries real value. Traditional valuation approaches (which rely heavily on single-point deterministic forecasts) will overlook that value. Approaches that recognize the value of these real options have merit.

Real Options

An option generally reflects an opportunity, but not a requirement, to act. For example, a financial call option, as shown in Exhibit 2, gives its owner the right — but not the obligation — to purchase stock at a certain price (the strike price) by a certain date (the maturity).

Assume that someone owns a call option for Apple stock with a strike price of $300 and a maturity of one year, and the Apple stock is currently trading at $250. The call option is currently "out-of-the-money" — in other words, a rational investor would not pay $300 now for something worth $250, resulting in a $50 loss. However, that does not mean that the call option is currently worthless. There is still time for Apple's stock price to increase above the strike price, resulting in a gain or the option being "in the money."

Suppose that there was a 40 percent chance Apple's stock would increase to $350 within a year and a 60 percent chance that it would decrease to $200. This means that there is a 40 percent chance of exercising the option and receiving net $50 ($350 less the $300 strike price), and a 60 percent chance of letting the option expire as being worthless. In this example, the call option would be worth $20 today, even though it is currently out of the money.[6]

"Real" options are conceptually similar to financial options but involve the right or opportunity to make a certain business decision involving the company's projects. This might include the decision to expand a factory, invest in research and development, or build a commercial property. Unlike financial options, real options are not often separately traded in open markets. Other approaches must be taken to understand their value.[7]

Real options are present across many industries and recognize the additional value provided from the flexibility to modify plans and projects over time. For E&P companies, real options frequently refer to developing reserves or drilling wells. The decision to drill a well can be thought of in much the same way as a call option. The investment required is the strike price, while the expected payoff is informed from selling the production from the well after it is drilled. Management would not choose to drill the well under low oil and gas price outlooks, giving it the option to avoid an expected negative value projection.

Conversely, management could choose to wait to drill under higher price outlooks that would result in expected profitable projects. This option to drill or not drill (*i.e.*, to develop or not develop the reserves) represents a real option

3 Crude oil and natural gas futures prices can be found through a number of data sources, such as Bloomberg or CME. Price projections from economic models — such as the U.S. Department of Energy's Energy Information Administration's (EIA) Annual Energy Outlook or analyst forecasts — represent alternative sources of information on forward-looking estimates.

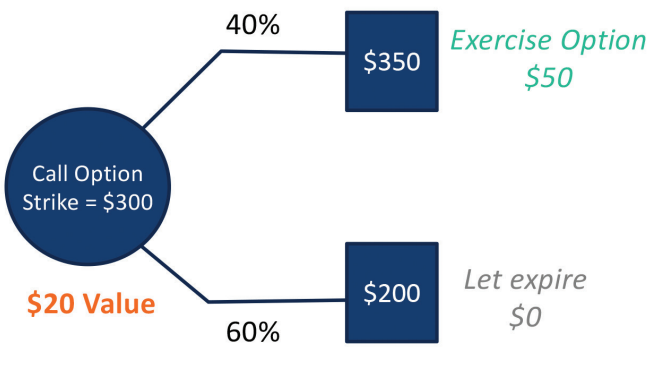
4 The EIA characterizes the magnitude of the uncertainty using the volatility information contained in the market-traded value of options contracts on oil and natural gas. More detail about the EIA's methodology can be found at "Short-Term Energy Outlook Supplement: Energy Price Volatility and Forecast Uncertainty," EIA (October 2009), *available at* eia.gov/outlooks/steo/special/pdf/2009_sp_05.pdf.

5 "Short-Term Energy Outlook," EIA (July 2024).

6 $50 x 40% + $0 x 60% = $20. This simplified example has so far excluded discounting for the time value of money. Assuming a risk-free rate of 4 percent, the current value after discounting would be $20 ÷ 1.04 = $19.23.

7 For further detail on real options valuation, *see* Jonathan Berk & Peter DeMarzo, *Corporate Finance, Fifth Edition* (Pearson 2020) ("Chapter 22: Real Options"); Richard A. Brealey, Stewart C. Myers & Franklin Allen, *Principles of Corporate Finance, Thirteenth Edition* (McGraw-Hill Education 2020) ("Chapter 22: Real Options"). Avinash K. Dixit & Robert S. Pindyck, *Investment Under Uncertainty, First Edition* (Princeton University Press 1994); Lenos Trigeorgis, *Real Options: Managerial Flexibility and Strategy in Resource Allocation* (MIT Press 1996).

Exhibit 2: Financial Call Option Example



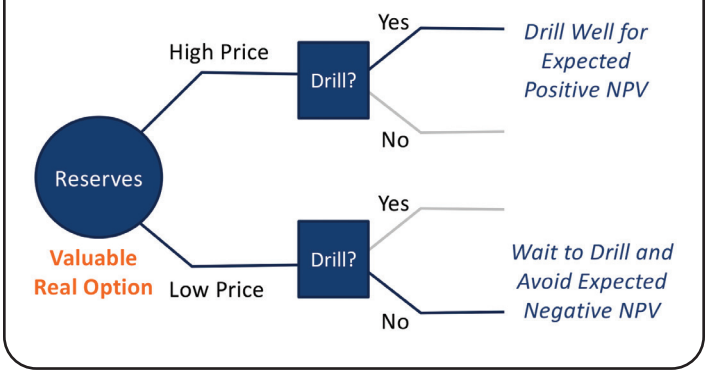
held by E&P companies. Just like an out-of-the-money call option might currently have value, an out-of-the-money real option (such as reserves that are not yet profitable to develop) similarly has value, as shown in Exhibit 3.

E&P companies in the normal course of business recognize that uneconomic reserves currently have value when considering their projects and drilling plans.[8] Management may perform scenario analyses, consider probabilistic outlooks, and develop stochastic models to understand the range of business outlooks and options available. However, valuations of the debtors in the bankruptcy and restructuring process tend to focus on deterministic, single-point oil and gas price projections that are prone to underestimating the value of undeveloped reserves.

For example, if the NYMEX futures prices suggest a low-commodity price environment (which is likely if a rapid decline in commodity prices had been the main driver for the E&P company's bankruptcy), then the deterministic approach inherent in the DCF or NAV would place little to no value on those reserves that are not planned for development (as shown in the bottom path in Exhibit 3). Those approaches would treat a currently out-of-the-money option as if it had no value, thereby overlooking the true value of those assets.

8 *See, e.g.*, John McCormack and Gordon Sick, "Valuing PUD Reserves: A Practical Application of Real Option Techniques," *Journal of Applied Corporate Fin.*, Vol. 13, No. 4 (2001), at pp. 110-15. *See also* Angelien G.Z. Kemna, "Case Studies on Real Options," *Fin. Mgmt.*, Vol. 22, No. 3 (Autumn 1993), at pp. 259-70.

Exhibit 3: E&P Company Real Option



In the *Chesapeake* bankruptcy, the debtor proposed that Chesapeake, on emergence from bankruptcy, would have an enterprise value of approximately $4.2 billion. The debtor's valuation approach relied largely on those traditional valuation approaches informed by then-prevailing NYMEX futures prices. Although Chesapeake had evaluated cash-flow projections under various sensitivities — in which a 10 percent increase to price projections resulted in a more than 50 percent increase in cumulative cash flow[9] — upon entering bankruptcy proceedings, the debtor's valuation expert did not perform any scenario analyses or consider this inherent upside and option value.

The unsecured creditors' committee (UCC) provided an alternative valuation that specifically considered the real option value of Chesapeake's undeveloped reserves, which estimated the debtor's enterprise value at $7.1 billion. The UCC's expert evaluated the development costs for Chesapeake's undeveloped reserves and those reserves excluded from management's drilling plans, and the potential for those currently out-of-the-money reserves to become economic to pursue given the volatility in commodity prices. Therefore, the UCC assigned value to those reserves that had been excluded under the traditional approaches used by the debtor.

The court ultimately determined the valuation at $5.129 billion. Upon emergence from bankruptcy in February 2021, the market valued Chesapeake at more than $6 billion. Such a valuation implied significant recoveries for the senior debtholders and minimal recovery for the unsecured creditors.

Conclusion

The value of E&P companies' real options is important to consider to avoid potentially significant undervaluation during the bankruptcy and restructuring process. Typical valuation approaches that rely on single-point outlooks often fail to fully capture the uncertainty in price projections. Real-option valuation offers a tool to incorporate that forecast uncertainty and recognize the additional value of flexibility to capitalize on new information or market conditions over time. abi

9 Chesapeake Form 8-K, June 26, 2020, Exhibit 99.2, Slide 5. The cumulative 2020-24 expected cash flows increased from $1.8 billion to $2.9 billion under an assumed 10 percent increase to NYMEX futures.