Paper

Optimize Farm-Out/In Analysis using Probabilistic Model

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Background

The high costs and risks associated with many oil and gas exploration projects often cause companies to seek partners to share those costs and risks before embarking on major expenditure programs.

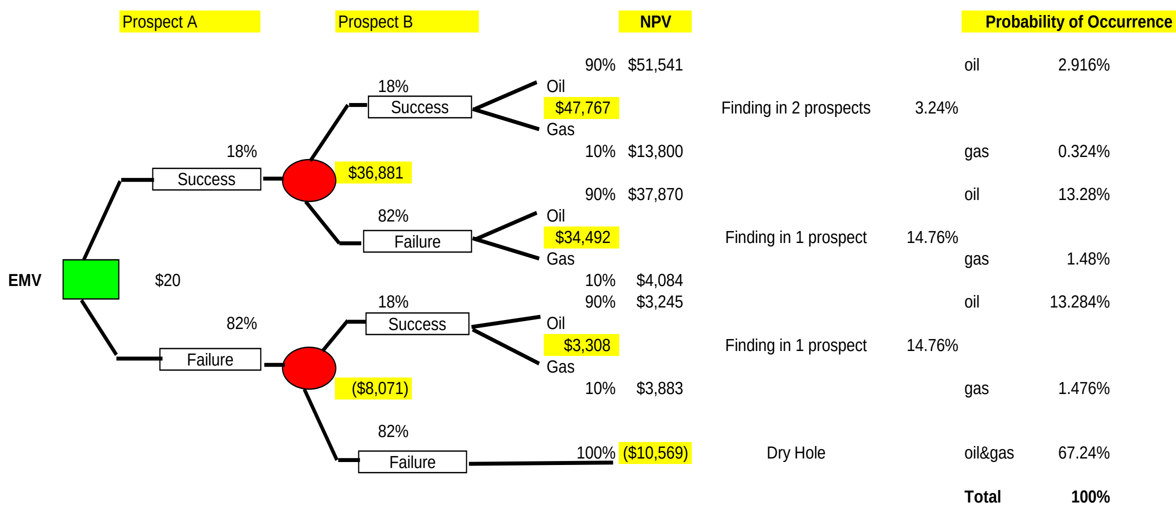
In this case, partnerships terms in exploration program of block X are negotiated as farm-in deals in which Company (i.e. farmor) as the holder of this block license, agrees to assign part of its interest to a third party (i.e. farminee). To earn an interest in this exploration block, the farminee may agree to fund a specified part of the exploration work program. In other words, farminee will pay a certain percentage of the costs of an exploration well in to earn the certain percentage of working interest in block X.

A study of farm out analysis for Block is conducted to optimize farm-out analysis using probabilistic model. The probabilistic methods have an advantage over deterministic methods by being able to systematically incorporate the risks associated with a range of future uncertainties in the exploration program.

A risked economic evaluation of a two pay zone prospect i.e. prospect A and B in block X illustrates how probabilistic simulation modeling and deterministic valuation and risk analysis techniques combine to provide useful insight to economic evaluation of a farm in opportunity.

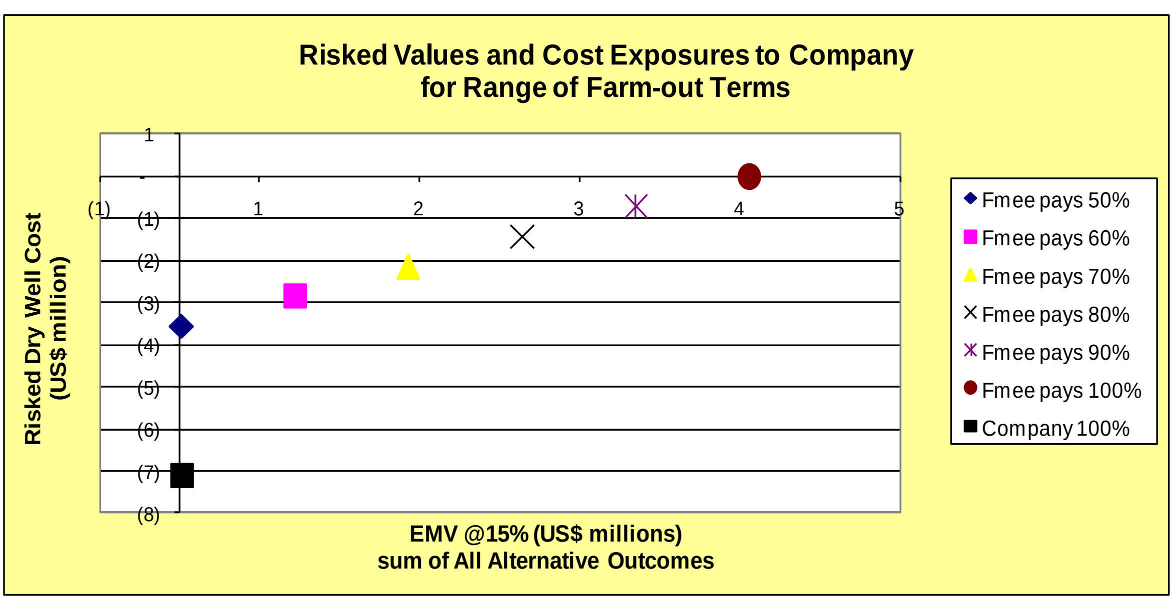
Risk Analysis (1)

In this case, Company had the perception of risk for prospect A and B in Block X i.e. 12% of chance of success.



From the above figure, it is clear that making a discovery in more than one prospect has a very low probability. Company calculates a probability of 3.24% of finding oil in two prospects.

It is instructive to analyze the dry-hole risked cost versus the total most likely EMV for the prospect.



Risk Analysis (2)

The previous figure shows the deterministic calculations of these parameters for the most likely input assumption based on the previous study and the farminee for a range of farm-in terms (varying from the farminee paying 100% to 50% of the exploration well cost to earn a 50% working interest in the contact).

The risked dry hole cost versus the prospect EMV for Company with no farm-in terms (i.e. 100% prospect case) is plotted for comparison. As the farminee pays a greater share of the exploration well cost, the risked dry hole cost decreased for Company, reaching zero when the farminee pays 100% of the well cost and the EMV for Company increases.

From the previous figure, it was suggested that the farminee would have to pay more than 50% of the exploration well costs to earn a 50% working interest for the EMV of Company to be greater than in the case where Company retains 100% working interest in block X.

The figure also illustrates that all the farm-in terms analyzed reduce the dry hole cost exposure of Company relative to the no-farm-in case. Reducing cost exposure may be a more important driver to Company than maximizing EMV in negotiating farm-in terms.

Assumptions

Farm-in terms can be evaluated in further detail through risk analysis and evaluation that establish the probabilities associated with certain risked values and quantify the downside risk of both parties. This requires probabilistic methods based upon Monte Carlo Simulation.

The objectives of probabilistic analysis would be to aid decisions specific for Company to decide whether it make sense to farm out or if it does make sense to farm out, on what promoted terms should it do so.

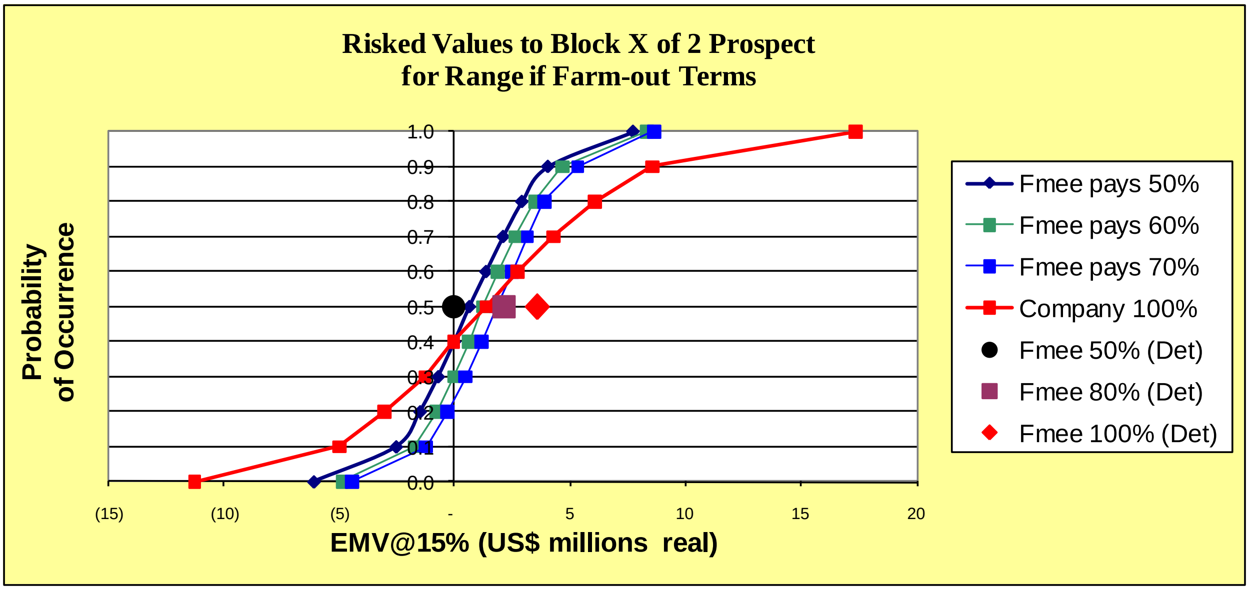
Using a probabilistic model to complement the deterministic cash flow model provides the analyst with more confidence in making such decisions than just using a deterministic model.

Input Variables	P10	Mode	P90
Oil Price $/bbl	25.0	32.0	40.0
Cost Escalation / year	3.5%	5.00%	6.5%
Production Performance Factor	0.75	1.00	1.10
Development Capex Performance	0.60	0.90	1.10
Exploration Capex Performance	0.70	0.95	1.10

For the probabilistic Monte Carlo model, the study defines distributions for five parameters (table), which are to be used as input variables for the simulation. Oil price and reservoir productivity are the two parameters that have greatest impact on prospect value. The variables such as capital expenditure, operating expenditure, and production are varied through use of performance ratios.

In this study, all variables are modeled as triangular distributions, and all input parameters are assumed to be independent of each other. The most likely values for the triangular distributions are those used for the most likely deterministic calculation. One thousand iterations have been performed in each Monte Carlo simulation run.

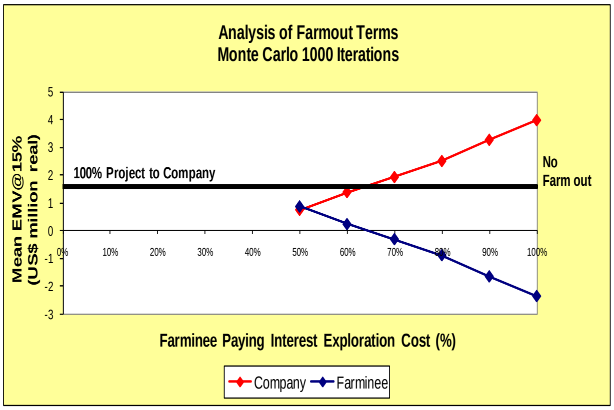
Result (1)

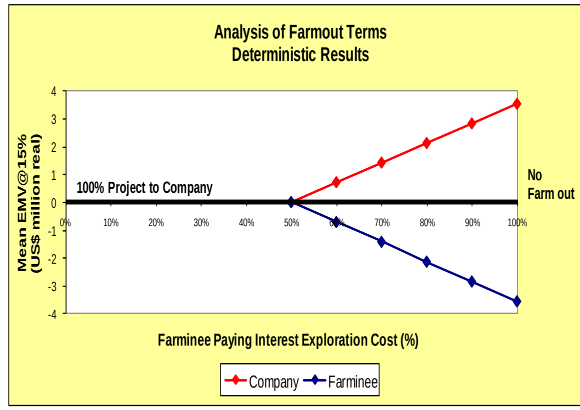


This figure illustrates the EMV simulation results plotted as cumulative probability distributions for three different farm-in terms. The no-farm-in case distribution is plotted for comparison. The deterministic most likely EMV calculations for Company where farminee pays 50%, 80% and 100% of the exploration well cost are also shown.

The deterministic values lie to the high side of their respective probability distributions. The farm-in case distributions show significantly narrower ranges of values than the no farm-in case (i.e. less risk for Company in the farm-in cases regardless of farm-in terms within the range analyzed). The above diagram shows how the farm-in cases reduce upside potential as well as downside risked values of a prospect and focus on farm-in terms that fit a Company's particular risk profile or preference.

Result (2)





The figure plots the mean of the EMV @15% distribution for Company and the farminee versus different paying percentages of the exploration well costs relating to the range of farm-in terms analyzed for the farminee to earn a 50% working interest in the contract.

The figure illustrates clearly how the mean EMV for Company increases as the mean EMV for the farminee decreases with the higher paying interest for the farminee. At 100% paying interest for the exploration well, the farminee has a negative mean EMV, indicating that such terms are unlikely to be acceptable to the farminee.

At 50% paying interest (i.e. “heads-up deal”) the mean EMV for the farminee is slightly the same as the mean EMV for Company, because it was assumed farminee places the same chance of success as the farmor on the prospect. The higher chance of success the farminee places on the prospect, the higher the EMV for the farminee.

Comparing the deterministic most likely EMV calculations with the means of the probabilistic EMV distributions as shown in the second chart in the figure, both deterministic and probabilistic methods show similar trends, but the mean values are significantly higher than the most likely values. This results in the prospect overall looking more economically attractive from the mean value probabilistic calculations.

The no farm-in case (i.e. 100% prospect to Company) is plotted in the figure for both calculation methods. From Company’s perspective, its EMV for farm-in terms exceed the no-farm-in case at a 65% paying interest for the farminee based on the means of the probabilistic calculations, whereas based on the deterministic calculations this is only greater than a 50% paying interest.

Analysis on Offering Proposal

During this farm-out program in Block X, there were two proposals from two Farminees (party A and B) who both have interest in this block.

1. Proposal A

Party A has proposed as follows :

- take 60% working interest and be operator after 3 years
- carry first well at the well cost with maximum exposure of $ 4 MM excluding $2.60 MM signature bonus

Based on the result of probabilistic model, for 50% working interest, farminee should pay greater than 65% of exploration cost for increased the Company's EMV rather than no-farm-in scenario. As our scenario in block X valuation, the total exploration cost from 2005 to 2007 is $11.5MM. If Party A only spend $4 MM or 34.5% of total exploration cost to take 60% working interest, this proposal is relatively not attractive for Company.

2. Proposal B

Party A and B agreed to get a joint venture with Company in this block with proportion as follow: 45% Company, 40% Party A and 15% Party B

The other conditions are as follows:

- Party A will commit to $4 MM drilling program regardless of the number of wells and 50% of $2.3 MM signature bonus.
- Party B will commit to $2 MM drilling program regardless of the number of wells and 50% of
- $2.3 MM signature bonus and after 3 years Party B has option to buy another 5% of Company share at market price

This proposal combined exploration cost of $6 MM (52.2% of total exploration cost) from both farminees to get 55% working interest. Although the percentage of exploration cost share still lower than the probabilistic result i.e. 65% of exploration cost, this scenario is more attractive than the previous one because there is a signature bonus of $2.3 MM paid by both farminees.

Conclusion

Based on such an analysis of the block X Farm-out, there do appear to be farm-in terms that could be attractive to both parties i.e. Farminee pays between 60% and 70% of exploration well costs to earn a 50% working interest. However, If Company is subject to capital constraints and under time pressure to drill an obligation well it may accept farm-in terms with little or no promote to limit its financial exposure and down side risk. Alternatively, the farminee may be prepared to accept less than optimal farm-in terms on this prospect in exchange for an interest in the upside potential of other possible prospects within the permit.

This risked economic analysis, however comprehensive, is not by itself going to establish a deal or guarantee a profitable outcome. It will, nevertheless, provide both parties with significant insight into block X that should aid in better decision making for both parties.

“The probabilistic model is able to systematically incorporate the risks associated with a range of future uncertainties in the oil and gas project.”