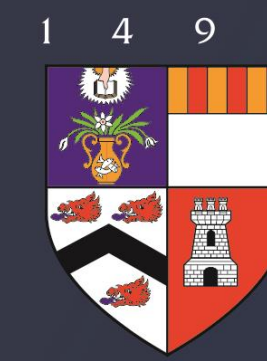


The Effect of Corporate Hedging on Investment Appraisal and Risk Management in the Petroleum Upstream Industry

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INTRODUCTION

An explorative study on the principle-agent moral hazard issue and the use of derivative hedging as a resolution to the dispute.

- Annual reports and industry surveys report a staggering use of crude oil derivative instruments.
- Whilst shareholders can diversify away idiosyncratic risk, such as oil price, these risks effect a manager's invested human capital.
- Due to manager and shareholder's misaligned risk preferences, managers are likely to underinvest or reject risk-inherent positive NPV projects.
- Hedging is the means of purchasing assets in the market to offset price variability.
- Hedging therefore may serve to stabilise investment profitability and thus protect the management's position within the firm threatened by price risk.

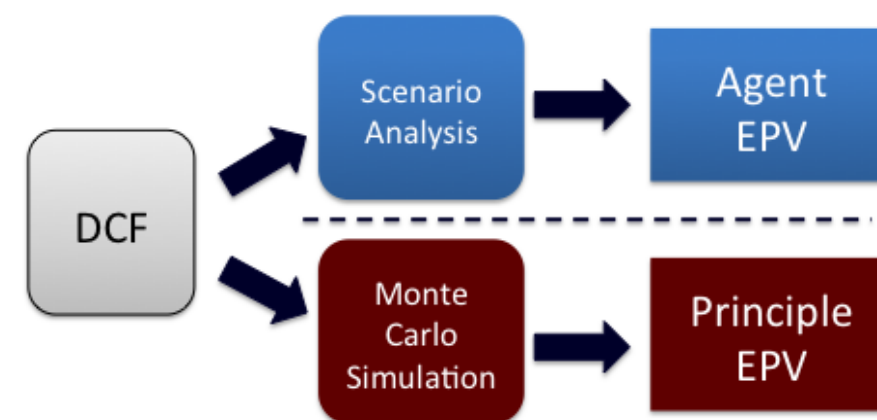
RESEARCH QUESTIONS

- As hedging has a net zero market value, what are the benefits of hedging at the project level?
- Does price risk affect the value and perception of an oil extraction project?
- Does project size affect manager/shareholder perception to risk?
- Do managers and shareholders disagree wrt. to capital budgeting?
- Can hedging help to realign risk-averse managers with risk-neutral shareholders?

METHODOLOGY

3 projects were appraised to provide an EPV outcome and a secondary probability measure of NPV risk.

Analysis undertaken:



Discounted Cash Flow Analysis

- Provided base case deterministic NPV values for all 3 projects.
- Project 1, 2 and 3: 10, 100, 1000 mmbbls respectively.
- Sensitivity Analysis revealed oil price and development cost as strongest determinant of profitability.

Scenario Analysis

- 9 scenarios per project generated using high, reference and low oil price and development costs.
- Base year oil price \$/bbl: 52.0, 71.0, 135.0
- Base year devex \$/bbl: 13.0, 18.5, 50.0
- Mean EPV from scenarios.

Monte Carlo Simulation

- 10,000 stochastic simulations of lognormal oil price and development costs per project.
- Mean EPV taken from histogram.

RESULTS

Investment Project	Post-Tax DCF NPV	Principle		Agent	
		Average ENPV (US\$ billions)	Decision	P(NPV < 0) < t	Decision
1	1.73	1.74	Accept	P(9.44) < t	Accept
2	6.34	3.75	Accept	P(30.0) > t	Reject
3	44.22	9.62	Accept	P(35.4) > t	Reject

- EPV < NPV: Uncertainty reduces the point estimate market value of a project.
- Risks of -ve NPV increases as project size increases.
- The proxy for risk-averse manager's project selection is P(NPV < 0) < t where is 20.0% chance of -ve NPV.
- Principle and agent are unanimous in their decision to accept Project 1 @ 10mmbbls.
- Moral hazard was found for Project 2 and 3 as although accepted by shareholders they are rejected by managers.
- The monetary loss to shareholders therefore is \$3.75b and \$9.62b for Project 2 and 3 respectively.

CONCLUSION

- Managers may not select projects which maximise shareholder value in the face of significant uncertainty.
- The larger, more capital intensive and/or longer the duration of investment – the more risk averse a manager will be.
- Financial Hedging can reduce (or eliminate) the uncertainty and hence relax managerial aversion to risk and insure against the risks to their human capital.