Valuation of “options in projects” in practice using DVP 2.0 beta

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Learning Objectives

- Brief Presentation of DVP 2.0
  - Introduction
  - Valuation capabilities - methods
- Case: R&D in the automotive industry
  - Introduction
  - Real options involved
  - Valuation using DVP 2.0
  - HYBRID real options / decision analysis approach
Dynamic Valuation Platform, Version 2.0.0
Developed by Dynamic Decisions
- http://www.ddecisions.org
- Boston contact: Raul Guerrero raul.guerrero@ddecisions.com
Beta test: If interested in trying, contact Raul!
Capabilities:
- DCF/NPV analysis
  - Excel compatibility
- Parameters estimation
  - Statistical analysis on financial data
- Real options valuation
  - Complex options structures
  - Implicit application of Decision analysis
  - Lattice / Simulation
- Platform building
  - Excel code generator

Real options valuation: Options map
- Represents interactions of options
- Allows average, addition and exclusion operators:
  - Sequential compound options
  - Parallel compound options
  - Exclusive options
  - Also: switching options!
Case: R&D of new bumper technology

- Major automobile manufacturer valuating R&D project
- Technology will not affect car market, only production cost/car
- Phases of project:
  - Research & development
  - Deployment
- DCF value = $85m
- Sources of risk
  - Success of R&D (market or private?)
  - Cost savings per car sold (market or private?)
  - Cars sold (market or private?)
- Before starting to think real options:
  - Is there flexibility in this R&D effort?

Sequential decision making (flexibility)

Sources of risk:
- Success of R&D
- Cost savings per car sold
- Cars sold
Case: R&D of new bumper technology

- Existence of both market & private risks makes pure RO analysis controversial and hard to justify

- Two viable approaches:
  - Market Asset Disclaimer (MAD)
    - Run Monte-Carlo simulation of all risks,
    - Extract a mean and StD,
    - Solve RO for an aggregate underlying asset
    - See Copeland & Antikarov, Real Options (2000)
  - HYBRID real options/decision analysis approach
    - Explicit distinction between market and private risks
    - Decision analysis → private risks
    - Real Options analysis → market risks
    - Followed by Neely
    - Recommended by Borison

Real options structure

- 1st option = American call ($P = S - K$)
- Avg operator = chance node in decision analysis
- Pink diamond = committed payoff (= 0 in this case)
- Blue diamond = Generalized American option
Case: R&D of new bumper technology

Modeling private risks

- R&D success
  - Data from interviews with engineers
  - 80% success rate, at this stage of research
- Benefits
  - Assumed to follow lognormal distribution
    - Strictly positive; negative benefits are regarded as failure of R&D
  - Given current production volume:
    - Approximation of lognormal distribution
      - High benefits/car
        - HiBen = $173m, \( p(\text{HiBen}) = 0.185 \)
      - Medium benefits/car
        - MedBen = $143m, \( p(\text{MedBen}) = 0.63 \)
      - Low benefits/car
        - LoBen = $120, \( p(\text{LoBen}) = 0.185 \)
  - Values (HiBen, MedBen, LoBen) discounted at \( R_f = 5\% \) to date
  - Risk-free rate corresponds to private risks

Modeling private risks

Entering the “chance” nodes (Avg operators) in DVP
Case: R&D of new bumper technology

Model market risks

- Cars sales assumed correlated with stock returns
- Crunch data to find correlation: \( \ln \frac{PROD_{t+n}}{PROD_t} = 0.253 \ln \frac{S_{t+n}}{S_t} \)
- Find stock price statistics
  - Annual dividend \( \delta = 4.5\% \)
  - Annual volatility \( \sigma = 20.7\% \)
  - Current price (1998) \( S = $32.25 \)
- Express cash flow dynamics as

\[
CF = -\frac{250,000}{1.05} + \begin{cases} 
  \text{HiBen} \\
  \text{MedBen} \\
  \text{LoBen}
\end{cases} e^{0.253 \ln \frac{S}{32.25}}
\]

Modeling private risks

For each real option (diamond), enter
Payoff = \( P(S) \equiv P(V1) \)
Timing
Real options valuation: **Underlying assets & Parameters**

- Enter underlying asset characteristics
- Also possible with DVP:
  - Multiple assets, various dynamics:
  - Geometric Brownian Motion
  - Poisson jump processes
  - Bounded (absorbed or reflected)
  - Function and parameter definition

Real options valuation: **Solution algorithms**

- Simulation
- Binomial lattice
Case: R&D of new bumper technology

Results
- Using lattice methods: Value of project = $114.7m
- Using simulation: Value of project = $112.6 ± 2.6
- Compare to value without flexibility: Value of project = $85m
  Value of flexibility = $29.3m
- 26% of the value of the project stems from flexibility!
- Of course, this is expected value!
Conclusion

- Case study: Valuation of R&D in automotive industry
  - Complex option
  - Market & private risks
    - HYBRID real options / decision analysis approach
    - Decision analysis and real options
  - Valuation using DVP 2.0
- Brief Presentation of DVP 2.0
  - There is a program that values complex options...
  - …easily!