Investment Opportunities and Real Options

NPV Analysis

• Let capital cost of a project be $50M
• Next month value of project revealed
  – $55M with probability 0.5
  – $47M with probability 0.5
  – NPV = $1M > 0
  – Traditional rule: invest if NPV > 0.

What’s Missing?

• Value of Delay
  – Suppose no revenues lost by waiting one month and learning demand state.
  – NPV = (0.5)(55-50) + (0.5)(0) = $2.5M
  – Value of waiting = $1.5M
  – All NPVs calculated at time 0
What is wrong with NPV?

- Ignores opportunity cost of waiting
  - A cost of investing irreversibly today is giving up possibility of gaining valuable information on demand or costs of project.
- Ignores the value of creating options
  - Investment may be valuable because it opens up opportunities for further investments in the future
    - R&D: keeping a loss making factory open
- NPV=0 → Don’t exit, enter

Investment Opportunity Creates a Call Option

- Investment opportunities: a right, but not an obligation to make an investment
- Exercising an option by making an irreversible investment “kills” the option.
- Need to consider the cost of waiting for new information that may affect the decision.

Effect of Uncertainty

- NPV analysis underestimates effect of uncertainty: only consider effect on discount rate (higher risk premium)
- Need to consider effect of uncertainty on options
  - More uncertainty decreases value of investments that use up options (waiting more valuable)
  - More uncertainty increases value of investments that create new options
Strategic Consequences of Options

- Pre-emption
  - Build today to deter rivals
  - Signaling: costs speak louder than words
- Positioning
  - Rival reacts to product positioning
- Production Capabilities
  - Ability to punish

Preemption and Real Options

- Value of preemption: commitment may affect rivals’ actions.
- Cost of preemption: commitment destroys flexibility
  - Obsolete technology
  - Too large, small

Pre-Emption Example

Size of the market is 0 with probability 0.9 and 400 with probability 0.1

Expected size of the market = 40

Downward sloping demand, linear from $100.

Timing:

<table>
<thead>
<tr>
<th>market size revealed</th>
<th>competition</th>
</tr>
</thead>
<tbody>
<tr>
<td>you can build</td>
<td>others can't or not</td>
</tr>
<tr>
<td>others can build</td>
<td></td>
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</tbody>
</table>
Preemption?

- If market size turns out to be 0, massive excess capacity.
- If market size turns out to be 400, rivals build anyway, drive price to mc of capacity.
- Can’t recover full investment

Example 2

Size of the market is 200 or 400, each with probability ½.
Expected size of the market = 300
Price of capacity $10
Downward sloping linear demand from $100.

Timing:

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<table>
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<th>others can build</th>
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</tr>
</tbody>
</table>
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Capacity to Pre-empt?

- Depends on market structure
- Rivals enter if expected price > $10.
- If incumbent will accommodate, not possible to fully pre-empt
- If rivalrous, pre-emption profitable (high prices in good state, $10 in bad state)
Strategic Positioning

• Ideal if niche has room for one
  - Enterprise
  - Cost strategy: Dell, Walmart, SW, UPS
  - Fortune 500 services (24/7)
• Box rival to inferior location

Production Capabilities

• Tools for cooperation
  - Excess capacity
  - Multi-market contact
• Maintain capacity for punishment purposes
• Not used when cooperation successful
• Appears unprofitable to outsiders

Capital budgeting under uncertainty

• Return to good cash flow estimates high
  - Strategic analysis essential
  - Cannot extrapolate from current performance
• Capital budgeting strategy
  - Consider competitor’s capital budgeting problem
  - Incorporate forecast that strategy will change with new information.
  - Incorporate competitive uncertainty.
Summary

- NPV ignores option value of investments
- Option value considerations
  - Favor investments that preserve options like keeping a plant open
  - Disfavor investments that exercise options like building a plant
- Option value considerations increase as variability increases
- Commitment affects rival behavior, but exercises options