Real Options

Topics
- Decision Tree
- Real Options
  - Abandon
  - Expand
  - Delay

Flexibility & Options

Decision Trees - Diagram of sequential decisions and possible outcomes. Allow us to graphically represent the alternatives available to us in each period and the likely consequences of our actions.

- Decision trees help companies determine their Options by showing the various choices and outcomes.
- The Option to avoid a loss or produce extra profit has value.
- The ability to create an Option thus has value that can be bought or sold.

Options

- One of the fundamental insights of modern finance theory is that options have value.
- The phrase "We are out of options" is surely a sign of trouble.
- Decision trees for valuing "real options" in a corporate setting can not be practically done by hand.

Options

- Because corporations make decisions in a dynamic environment, they have options that should be considered in project valuation.
- Option to **Expand**: Has value if demand turns out to be higher than expected.
- Option to **Abandon**: Has value if demand turns out to be lower than expected.
- Option to **Delay**: Has value if the underlying variables are changing with a favorable trend.

Option to Delay: Example

Year	Cost	PV	NPV t	NPV 0
0	$ 20,000	$ 25,000	$ 5,000	$ 5,000
1	$ 18,000	$ 25,000	$ 7,000	$ 6,364
2	$ 17,100	$ 25,000	$ 7,900	$ 6,529
3	$ 16,929	$ 25,000	$ 8,071	$ 6,064
4	$ 16,760	$ 25,000	$ 8,240	$ 5,628

- Consider the above project, which can be undertaken in any of the next 4 years with r = 10 %. The present value of the benefits at the time the project is launched remain constant at $25,000, but since costs are declining, the NPV at the time of launch steadily rises.
- The best time to launch the project is in year 2 - this schedule yields the highest NPV when judged today.

Discounted Cash Flows and Options

- We can calculate the market value of a project (M) as the sum of the NPV of the project without options and the value of the managerial options implicit in the project.

M = NPV + Option

A good example would be comparing the desirability of a specialized machine versus a more versatile machine. If they both cost about the same and last the same amount of time the more versatile machine is more valuable because it comes with options.

Option to Abandon

Example

- Suppose that we are drilling an oil well. The drilling rig costs $300 today and in one year the well is either a success or a failure. The outcomes are equally likely. The discount rate is 10%.
  - The *PV* of the successful payoff at time one is $575.
  - The *PV* of the unsuccessful payoff at time one is $0.

Option to Abandon

- Traditional NPV analysis would indicate rejection of the project.
- Traditional NPV analysis overlooks the option to abandon.
- When we include the value of the option to abandon, the drilling project should proceed.

Valuation of the Option to Abandon

- Recall that we can calculate the market value of a project as the sum of the NPV of the project without options and the value of the managerial options implicit in the project.

M = NPV + Option