Capital Budgeting: Sequential Choices

(Welch, Chapter 13-3)

Ivo Welch

ABC's New Factory

ABC has already invested \$20 million in opening its new flagship factory. Finishing it will only require another \$5 million. But demand has recently dropped, and expected revenues are only \$400 thousand per year. The appropriate cost of capital is 10%.
Should ABC finish its half-finished factory?

ABC's Gadget Factory

ABC produces 100,000 gadgets.

Each gadget costs \$1 to produce.

The market price of gadgets is \$1.80 each.

- Demand is perfectly elastic.

To produce another 100,000 gadgets requires running the machine at night.

- These extra 100,000 gadgets however cost not \$1 but \$2 to produce.

One-Year (Exposition)

You own the factory for exactly one year.

The gadget price process is:

- With 10% probability, the output price doubles after exactly one year.
- With 10% probability, the output price halves after exactly one year.
- With 80% probability, the output price stays the same.

Other Parameters

So, **the expected price is \$1.89**.

Shutting down the plant, doubling production, or reopening it costs nothing.

The cost of capital is a constant 0% per year—for illustration.

ABC's Plant Value?

What is the value of this plant?

Is it $\$1.89 \cdot 100,000$?

Solve It!

What is the value of this plant?

How do you go about solving this?

Is Calculation Difficult?

Is it difficult to do this calculation for 5 years?

30 years?

With more than one or two choices?

Switching Costs

As before, but assume that switching the plant costs \$20,000. What is the value of this plant now?

How do you go about solving this?

Shutdown Costs of Oil Wells in 2020

“Real Options”

Real Option == Strategic Option

As an owner of a real option, do you like volatility?

Other Real Options?

Leverage a product into future markets.

Find product spinoffs. The ability to learn about (how to do) future products.

Stop the project if conditions are bad.

Delay or mothball-restart the project if conditions are bad.

Accelerate the project if conditions are good.

Expand the project if conditions are good.

The Value of Unbuilt Land

What is the value of unbuilt land in the boonies?

The Value of R&D

What is the value of R&D?

Real Option Conclusion

A real option is the flexibility to change in the future, *depending* on the *then*-prevailing conditions.

Such flexibility adds value and is one reason why you cannot take the expected price and multiply it by the expected quantity of output.

CEO Use

- 52% of managers do sensitivity analysis (not scenario analysis).
- 27% work with real options.
- 14% do simulations.

NOTE:

- In the web appendix to Chapter 12 (posted in the companion), there are a lot more examples of real options and decision trees.