



SESSION 20: THE ESSENCE OF REAL OPTIONS

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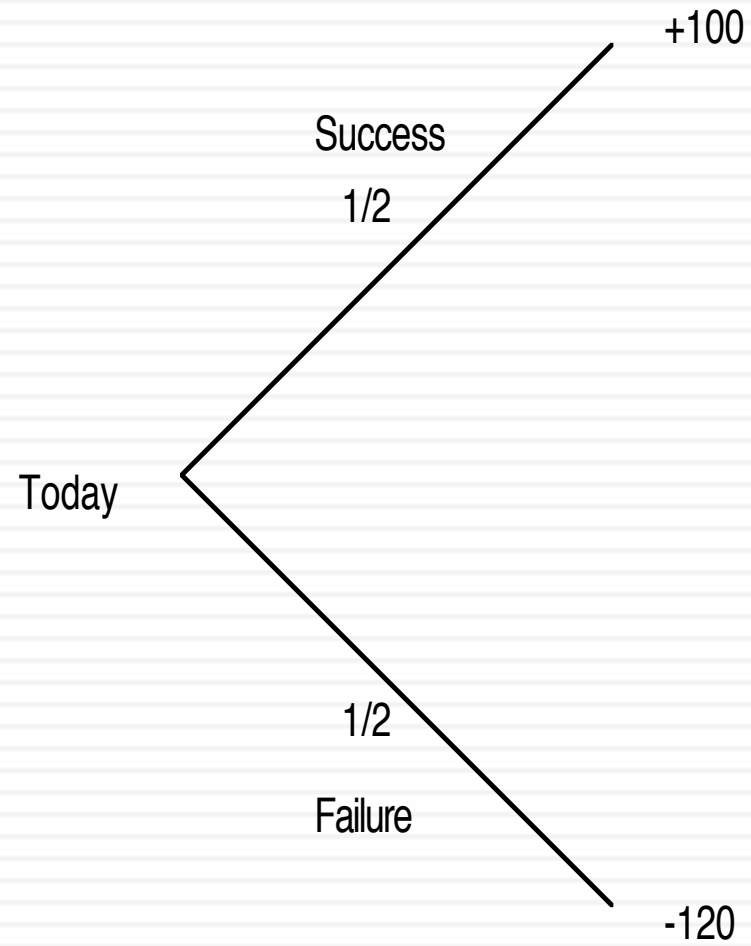
Underlying Theme: Searching for an Elusive Premium

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- Traditional discounted cashflow models underestimate the value of investments, where there are options embedded in the investments to
 - Delay or defer making the investment (delay)
 - Adjust or alter production schedules as price changes (flexibility)
 - Expand into new markets or products at later stages in the process, based upon observing favorable outcomes at the early stages (expansion)
 - Stop production or abandon investments if the outcomes are unfavorable at early stages (abandonment)
- Put another way, real option advocates believe that you should be paying a premium on discounted cashflow value estimates.

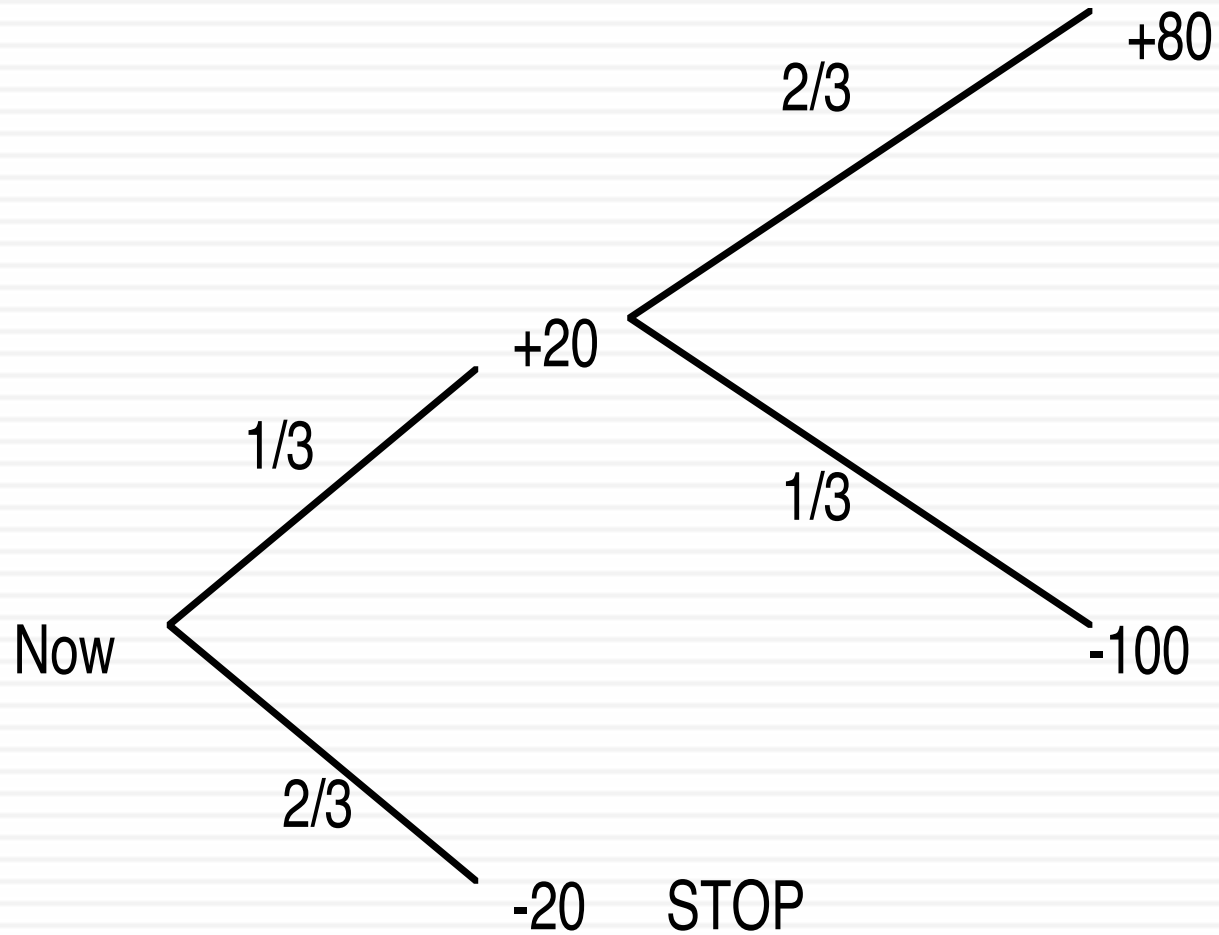
A bad investment...

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Becomes a good one...

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Three Basic Questions

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- When is there a real option embedded in a decision or an asset?
- When does that real option have significant economic value?
- Can that value be estimated using an option pricing model?

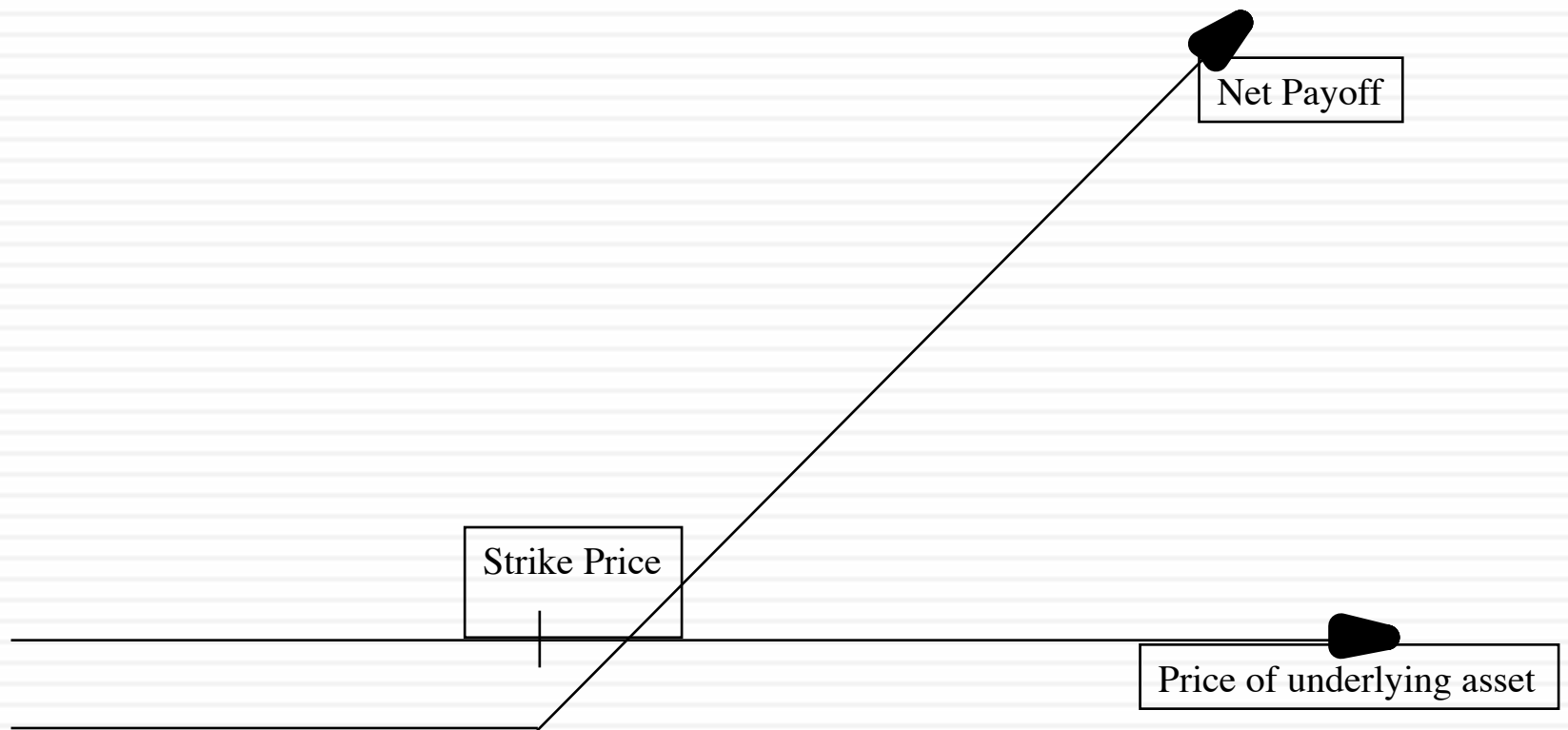
When is there an option embedded in an action?

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- An option provides the holder with the right to buy or sell a specified quantity of an underlying asset at a fixed price (called a strike price or an exercise price) at or before the expiration date of the option.
 - There has to be a clearly defined underlying asset whose value changes over time in unpredictable ways.
 - The payoffs on this asset (real option) have to be contingent on an specified event occurring within a finite period.

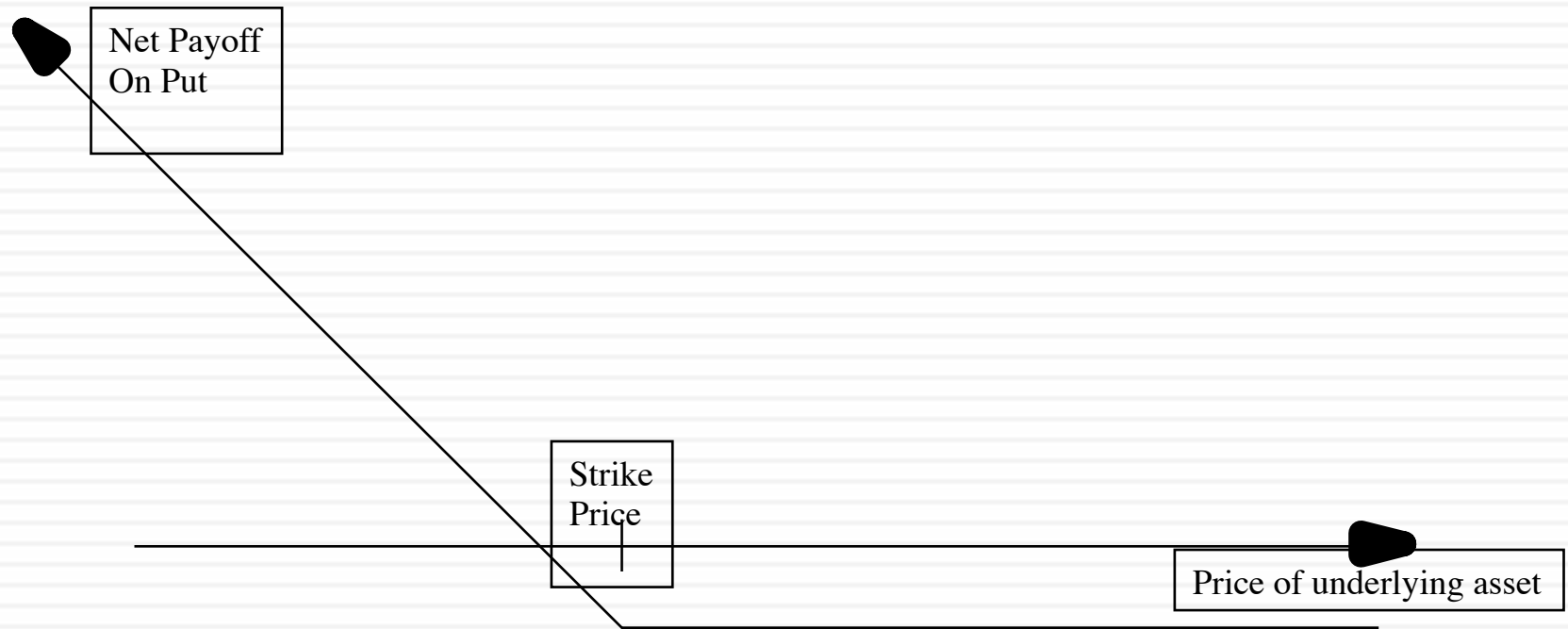
Payoff Diagram on a Call

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Payoff Diagram on Put Option

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When does the option have significant economic value?

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- For an option to have significant economic value, there has to be a restriction on competition in the event of the contingency.
 - In a perfectly competitive product market, no contingency, no matter how positive, will generate positive net present value.
- At the limit, real options are most valuable when you have exclusivity - you and only you can take advantage of the contingency. They become less valuable as the barriers to competition become less steep.

Determinants of option value

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- Variables Relating to Underlying Asset
 - Value of Underlying Asset; as this value increases, the right to buy at a fixed price (calls) will become more valuable and the right to sell at a fixed price (puts) will become less valuable.
 - Variance in that value; as the variance increases, both calls and puts will become more valuable because all options have limited downside and depend upon price volatility for upside.
 - Expected dividends on the asset, which are likely to reduce the price appreciation component of the asset, reducing the value of calls and increasing the value of puts.
- Variables Relating to Option
 - Strike Price of Options; the right to buy (sell) at a fixed price becomes more (less) valuable at a lower price.
 - Life of the Option; both calls and puts benefit from a longer life.
- Level of Interest Rates; as rates increase, the right to buy (sell) at a fixed price in the future becomes more (less) valuable.

When can you use option pricing models to value real options?

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- The notion of a replicating portfolio that drives option pricing models makes them most suited for valuing real options where
 - ▣ The underlying asset is traded - this yields not only observable prices and volatility as inputs to option pricing models but allows for the possibility of creating replicating portfolios
 - ▣ An active marketplace exists for the option itself.
 - ▣ The cost of exercising the option is known with some degree of certainty.
- When option pricing models are used to value real assets, we have to accept the fact that
 - ▣ The value estimates that emerge will be far more imprecise.
 - ▣ The value can deviate much more dramatically from market price because of the difficulty of arbitrage.

Choices of Models

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- Black-Scholes Model: Makes restrictive assumptions about volatility (fixed over option life) and early exercise (none) and price process for underlying asset (no jumps), but arrives at a parsimonious model where the option value is a function of only 6 observable inputs:
 - ▣ The current price of the underlying asset
 - ▣ The strike price on the option
 - ▣ The life of the option
 - ▣ The variance in the price of the underlying assets
 - ▣ The riskless rate for the option life
 - ▣ Dividends over the life of the option (not in original Black Scholes)
- Binomial Model: This is a more general and less restrictive model but it requires a great deal more data on how the price of the underlying asset will evolve over time.

Choice of Option Pricing Models

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- Most practitioners who use option pricing models to value real options argue for the binomial model over the Black-Scholes and justify this choice by noting that
 - ▣ Early exercise is the rule rather than the exception with real options
 - ▣ Underlying asset values are generally discontinuous.
- If you can develop a binomial tree with outcomes at each node, it looks a great deal like a decision tree from capital budgeting. The question then becomes when and why the two approaches yield different estimates of value.

Key Tests for Real Options

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- Is there an option embedded in this asset/ decision?
 - ▣ Can you identify the underlying asset?
 - ▣ Can you specify the contingency under which you will get payoff?
- Is there exclusivity?
 - ▣ If yes, there is option value.
 - ▣ If no, there is none.
 - ▣ If in between, you have to scale value.
- Can you use an option pricing model to value the real option?
 - ▣ Is the underlying asset traded?
 - ▣ Can the option be bought and sold?
 - ▣ Is the cost of exercising the option known and clear?