



VALUATION: PACKET 3
REAL OPTIONS, ACQUISITION
VALUATION AND VALUE
ENHANCEMENT

Aswath Damodaran

Updated: January 2019



REAL OPTIONS: FACT AND FANTASY

Aswath Damodaran

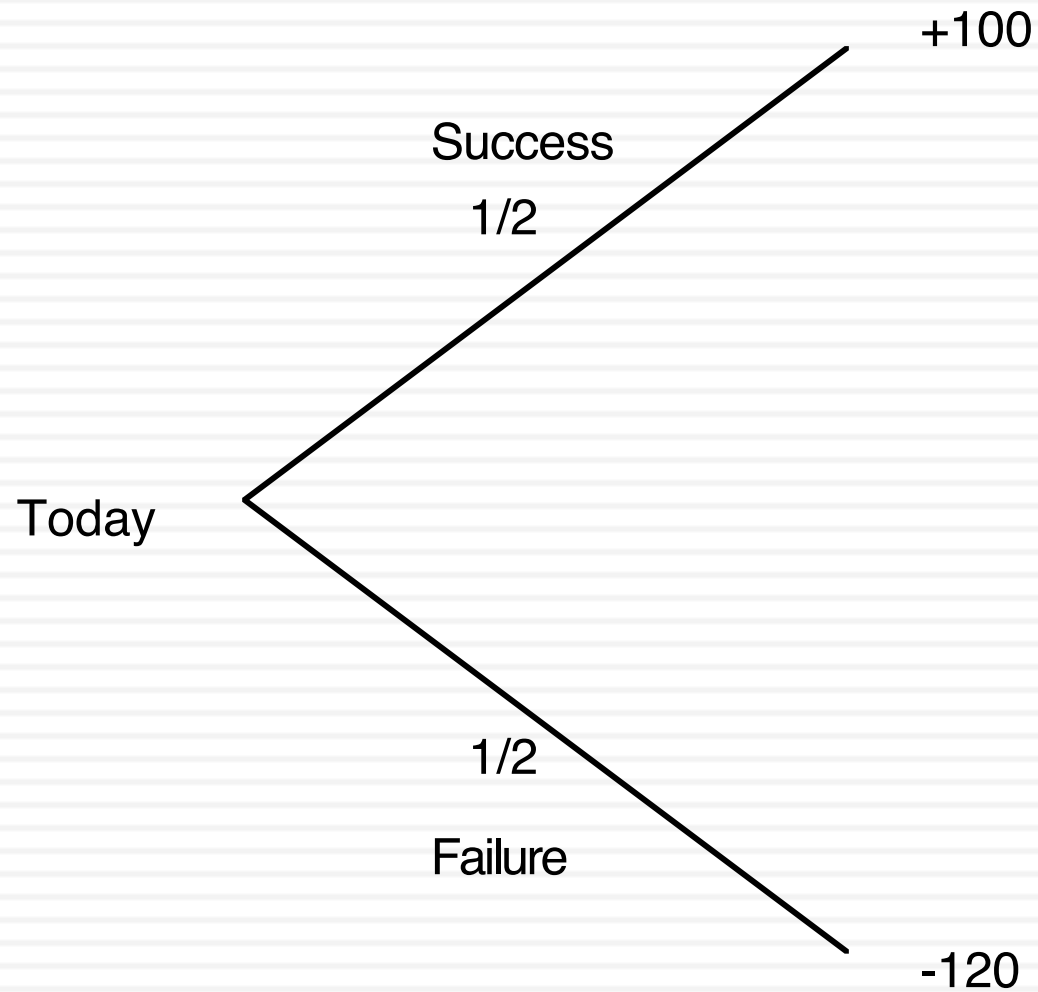
Underlying Theme: Searching for an Elusive Premium

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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.

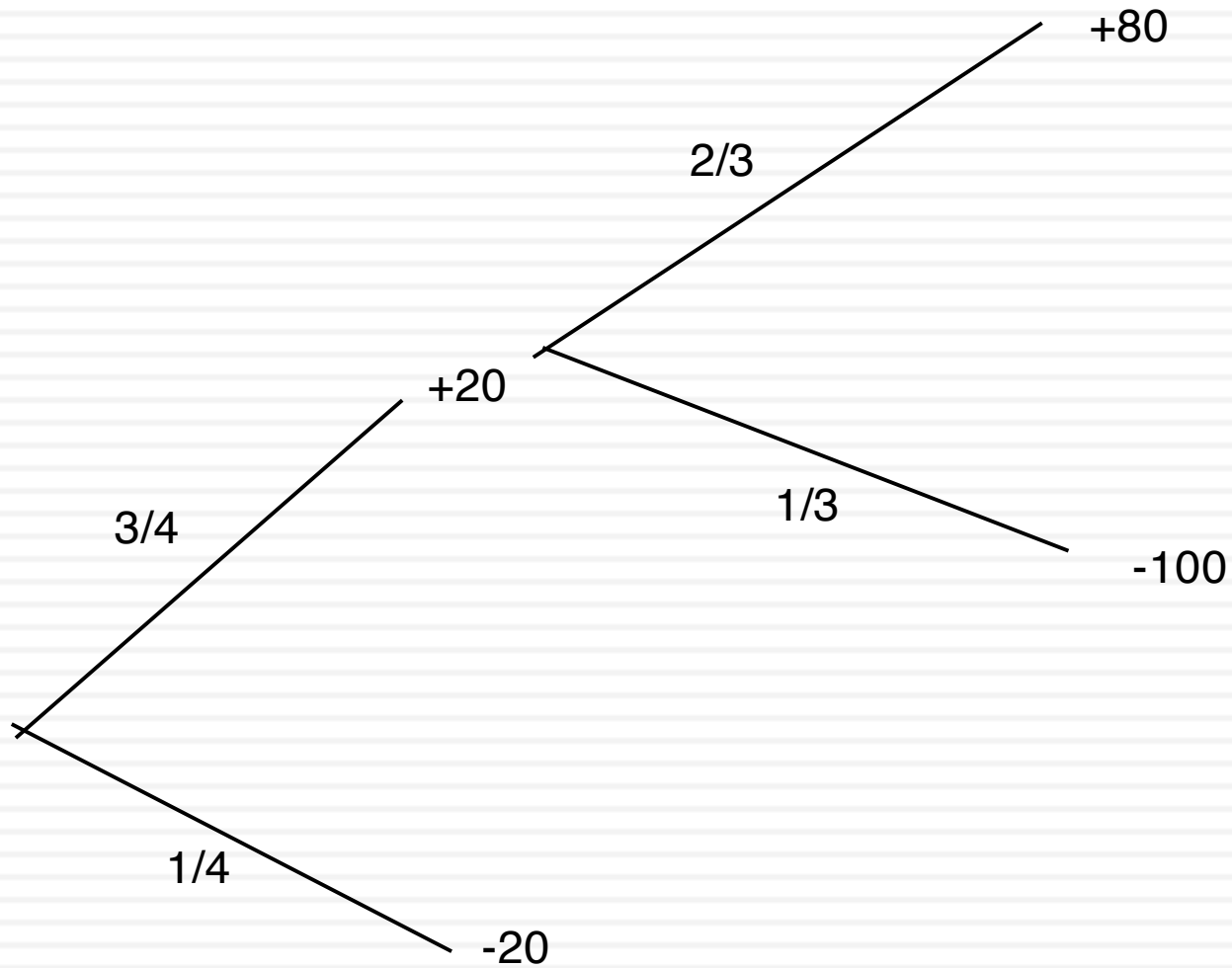
A bad investment...

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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?

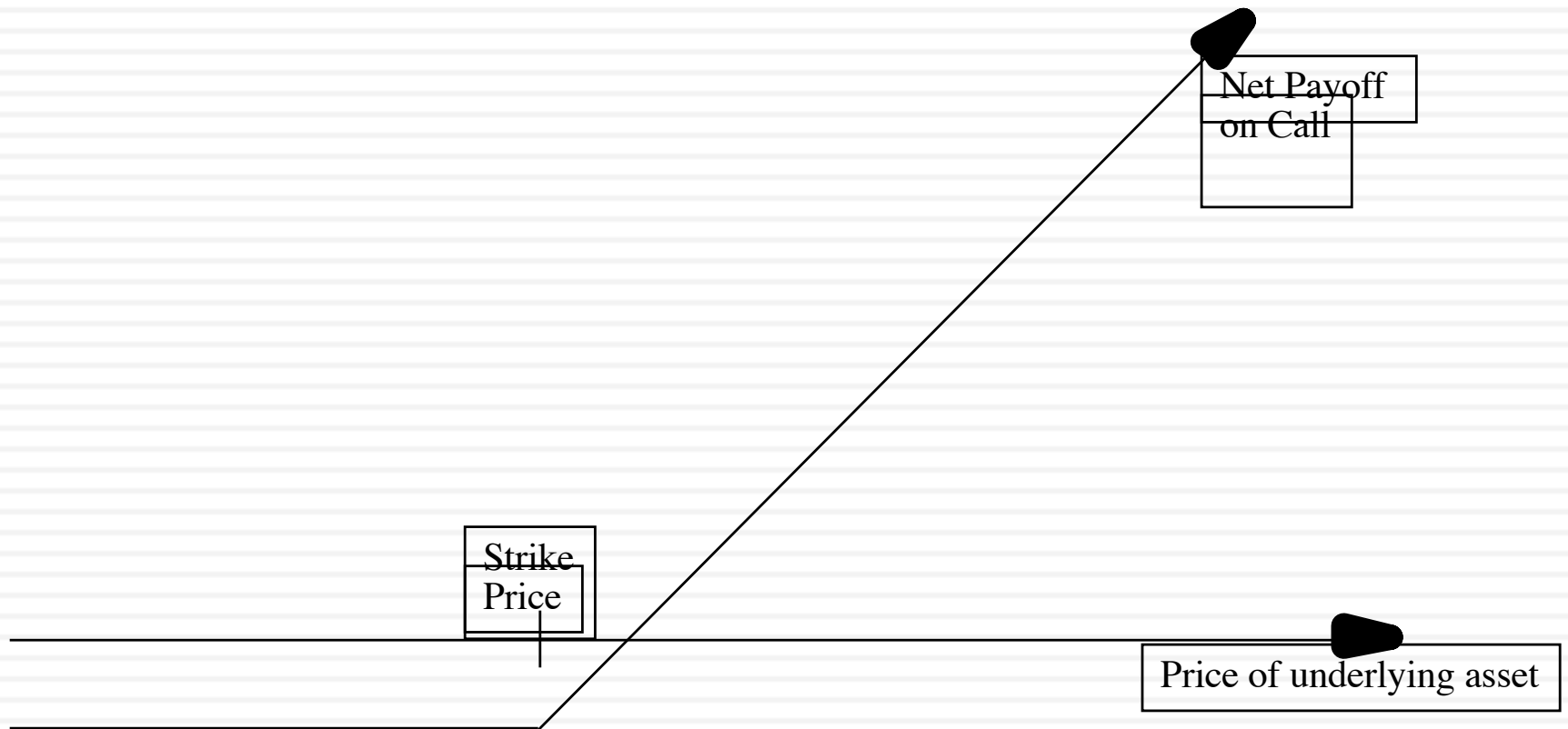
When is there an option embedded in an action?

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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.

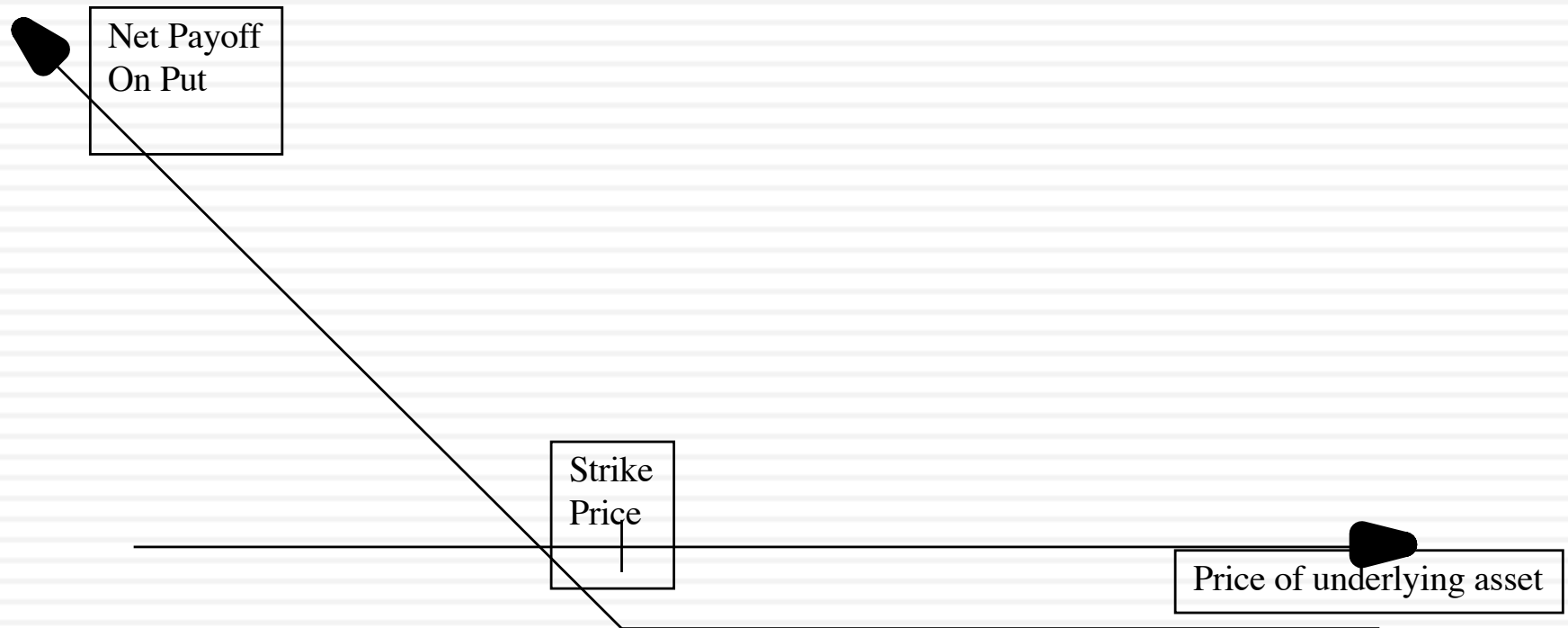
Payoff Diagram on a Call

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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.

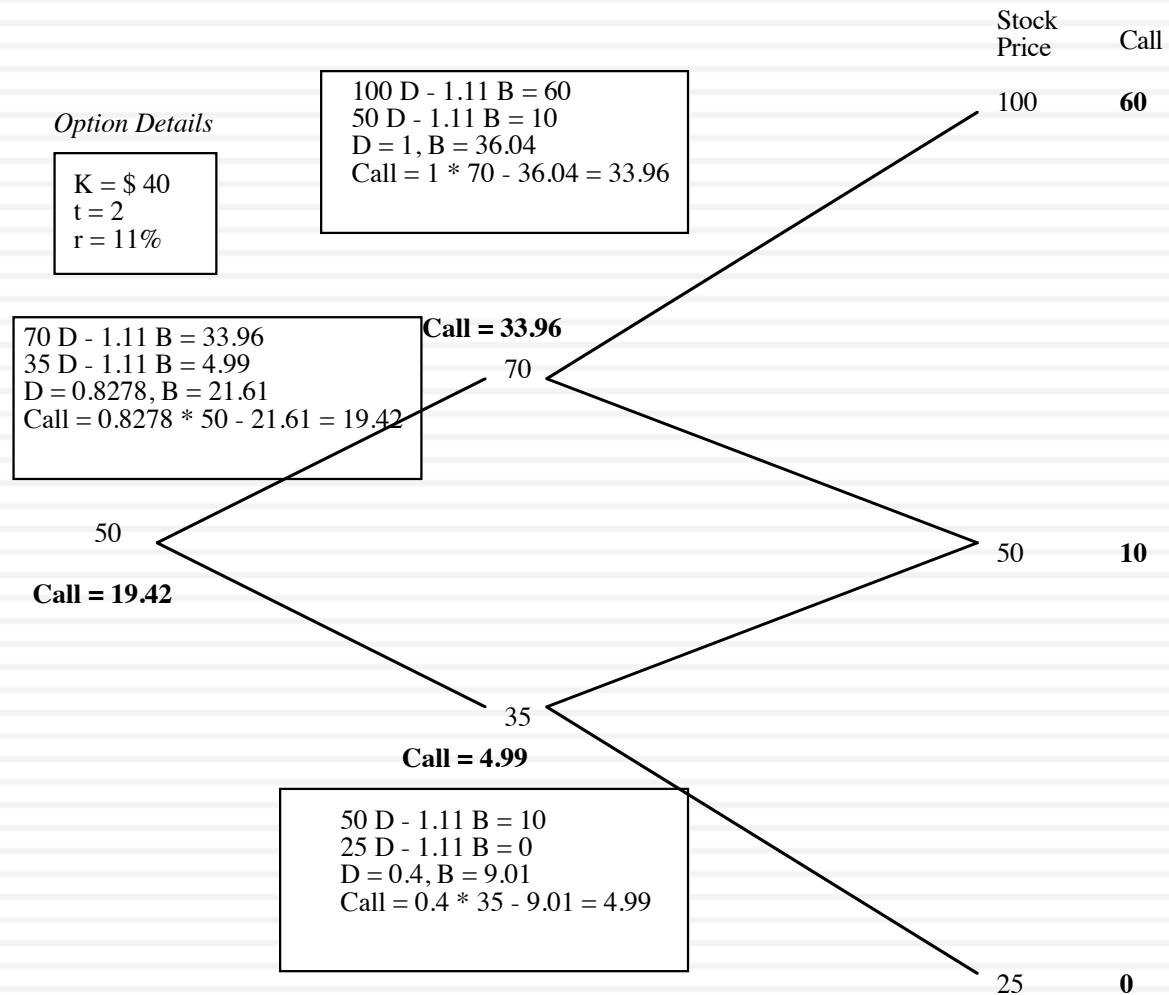
Creating a replicating portfolio

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- The objective in creating a replicating portfolio is to use a combination of riskfree borrowing/lending and the underlying asset to create the same cashflows as the option being valued.
 - Call = Borrowing + Buying D of the Underlying Stock
 - Put = Selling Short D on Underlying Asset + Lending
 - The number of shares bought or sold is called the option delta.
- The principles of arbitrage then apply, and the value of the option has to be equal to the value of the replicating portfolio.

The Binomial Option Pricing Model

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The Limiting Distributions....

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- As the time interval is shortened, the limiting distribution, as $t \rightarrow 0$, can take one of two forms.
 - If as $t \rightarrow 0$, price changes become smaller, the limiting distribution is the normal distribution and the price process is a continuous one.
 - If as $t \rightarrow 0$, price changes remain large, the limiting distribution is the poisson distribution, i.e., a distribution that allows for price jumps.
- The Black-Scholes model applies when the limiting distribution is the normal distribution, and explicitly assumes that the price process is continuous and that there are no jumps in asset prices.