

# The Value of Intangibles

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## Start with the obvious... Intangible assets are worth a lot and accountants don't do a good job in assessing their value

- Leonard Nakamura of the Federal Reserve Bank of Philadelphia provided three different measures of the magnitude of intangible assets in today's economy – an accounting estimate of the value of the investments in R&D, software, brand development and other intangibles; the wages and salaries paid to the researchers, technicians and other creative workers who generate these intangible assets; and the improvement in operating margins that he attributes to improvements to intangible factors. With all three approaches, he estimated the investments in intangible assets to be in excess of \$ 1 trillion in 2000 and the capitalized value of these intangible assets to be in excess of \$ 6 trillion in the same year.
- Baruch Lev has argued persuasively that the way in which accountants deal with intangibles is neither conservative nor informative. Expensing R&D, for instance, does understate earnings for high growth companies but it overstates earnings for low growth firms. In a paper with Paul Zarowin, he presents evidence that earnings at U.S. firms have become less correlated with stock prices and he attributes this phenomenon to the failure to accounting for intangible assets.

## So, what are intangible assets?

- The loosest and broadest definition of an intangible asset is that it is an asset that we can neither see nor feel. Using that definition, though, we can come up with a broad range of intangible assets including:
  - Franchises, copyrights and trademarks
  - Patents
  - Brand names
- To this list, we can add on what we consider the invisible assets including
  - Top-notch management
  - Loyal and well-trained workforce
  - Technological know-how

## And do we do them justice in valuation?

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- Critics of valuation analysts, in particular, and quantitative valuation models, in general, argue that we miss intangible assets because we are so focused on the bottom line - earnings and cash flows.
- Implicit in this criticism is the belief that if accountants do not show intangible assets on the balance sheet, we will miss these assets when we are doing valuation.

## The Solutions offered by Critics

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- Premium approach: Add a premium to the values that we arrive at for companies with substantial intangible assets. The magnitude of the premium is usually subjective and left to the analyst to estimate for individual companies.
- Book Value approach: Force accountants to come up with reasonable values for intangible assets and show them as assets on the balance sheet.

## Dangers of Ad-hoc approaches

- Double counting: For assets that already generate a portion of the earnings and the cash flows, adding a premium on to the value will be double counting value.
- Rules of thumb: Even when we are not double counting, there is a danger with using subjective rules of thumb to estimate the value of uncounted assets. For instance, technological prowess cannot add 20% to the value of a company. It has to be valued in each case, and may be worth 5% sometimes and 50% at other times.

# Categorizing Intangibles

	<i>Independent and Cash flow generating intangibles</i>	<i>Not independent and cash flow generating to the firm</i>	<i>No cash flows now but potential for cashflows in future</i>
Examples	Copyrights, trademarks, licenses, franchises, professional practices (medical, dental)	Brand names, Quality and Morale of work force, Technological expertise, Corporate reputation	Undeveloped patents, operating or financial flexibility (to expand into new products/markets or abandon existing ones)
Valuation approach	Estimate expected cashflows from the product or service and discount back at appropriate discount rate.	<ul style="list-style-type: none"> <li>• Compare DCF value of firm with intangible with firm without (if you can find one)</li> <li>• Assume that all excess returns of firm are due to intangible.</li> <li>• Compare multiples at which firm trades to sector averages.</li> </ul>	<p>Option valuation</p> <ul style="list-style-type: none"> <li>• Value the undeveloped patent as an option to develop the underlying product.</li> <li>• Value expansion options as call options</li> <li>• Value abandonment options as put options.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>• Life is usually finite and terminal value may be small.</li> <li>• Cashflows and value may be person dependent (for professional practices)</li> </ul>	With multiple intangibles (brand name and reputation for service), it becomes difficult to break down individual components.	<ul style="list-style-type: none"> <li>• Need exclusivity.</li> <li>• Difficult to replicate and arbitrage (making option pricing models dicey)</li> </ul>

## I. Valuing independent and cash flow producing intangible assets: Valuing a copyright

- Assume that John Wiley has been approached by another publisher who is interested in buying the copyright to this book (Damodaran on Valuation). To estimate the value of the copyright, we will make the following assumption.
  - The book is expected to generate \$150,000 in after-tax cash flows for the next three years and \$100,000 a year for the following two years. These are the cash flows after author royalties, promotional expenses and production costs.
  - About 40% of these cash flows are from large organizations that make bulk orders and are considered predictable and stable. The cost of capital applied to these cash flows is 7%.
  - The remaining 60% of the cash flows are to the general public and this segment of the cash flows is considered much more volatile. The cost of capital applied to these cash flows is 10%.



## Valuing Damodaran on Valuation

<i>Year</i>	<i>Stable Cashflows</i>	<i>Present value @ 7%</i>	<i>Volatile Cashflows</i>	<i>Present value @ 10%</i>
1	\$60,000	\$56,075	\$90,000	\$81,818
2	\$60,000	\$52,406	\$90,000	\$74,380
3	\$60,000	\$48,978	\$90,000	\$67,618
4	\$40,000	\$30,516	\$60,000	\$40,981
5	\$40,000	\$28,519	\$60,000	\$37,255
		\$216,494		\$302,053

## Franchise Value

- *Brand Name Value*: The franchise might have a brand name value that enables the franchisee to charge higher prices and attract more customers than an otherwise similar business. Thus, an investor may be willing to pay a significant up-front fee to acquire a McDonald's franchise, in order to take advantage of the brand name value associated with the company. This brand name value is augmented by the fact that the franchisor often provides the advertising for the product.
- *Product/Service Expertise*: In some cases, a franchise has value because the franchisor provides expertise on the product or service that is being sold. For instance, a McDonald's franchisee will have access to the standard equipment that McDonald's uses as well as the product ingredients (the special sauce on the Big Mac).
- *Legal Monopolies*: Sometimes, a franchise may have value because the franchisee is given the exclusive right to provide a service. For instance, a company may pay a large fee for the right to operate concession stands in a baseball stadium, knowing that they will face no competition within the stadium. In a milder variant of this, multiple franchises are sometimes sold but the number of franchises is kept limited to insure that the franchisees earn excess returns. New York City, for example, sells cab medallions that are a pre-requisite for operating a yellow cab in the city. They also have tight restrictions on non-medallion owners offering the same service. Consequently, a market where cab medallions are bought and sold exists.

## Businesses with personal components

- Some businesses have a personal component to them, and their value can be linked to this personal component. A doctor's practice or a highly rated restaurant are good examples. While these businesses may be very profitable, a significant portion of the profits may be attributed to the person running the business (the doctor or the chef).
- When paying for these businesses, you will have to value them on the assumption that this key person will leave after the sale. The resulting lower value will create a key person discount.
- This may allow for a negotiation process where the key person agrees to stay on to allow for a transition period.

## II. Firm-wide intangible assets- Ways of valuing

- Capital Invested: We can estimate the book value of an asset by looking at what a firm has invested in that asset over time. With brand name, for instance, this would require looking at advertising expenditures over time, capitalizing these expenses and looking at the balance that remains unamortized of these expenses today.
- Discounted Cash Flow Valuation: We can discount the expected incremental cash flows generated by the intangible asset in question to the firm. This will require separating out the portion of the aggregate cash flows of a firm that can be attributed to brand name or technological expertise and discounting back these cash flows at a reasonable discount rate.
- Relative Valuation: One way to isolate the effect of an intangible asset such as brand name is compare how the market values the firm (with the intangible) with how it values otherwise similar companies without the intangible asset. The difference can be attributed to the intangible asset.

## a. Valuing Coca Cola's brand name: Capital Invested approach

<i>Year</i>	<i>Total Selling and Advertising</i>	<i>Brand Name Related Expense</i>	<i>Amortization this year</i>	<i>Unamortized Expense</i>
1980	\$1,121	\$561	\$22.43	\$0.00
1981	\$1,189	\$594	\$23.77	\$23.77
1982	\$1,221	\$610	\$24.41	\$48.83
1983	\$1,376	\$688	\$27.52	\$82.56
1984	\$1,543	\$771	\$30.85	\$123.41
1985	\$1,579	\$789	\$31.57	\$157.87
1986	\$1,631	\$815	\$32.61	\$195.68
1987	\$1,777	\$888	\$35.53	\$248.73
1988	\$2,025	\$1,013	\$40.51	\$324.05
1989	\$2,232	\$1,116	\$44.64	\$401.76
1990	\$2,717	\$1,359	\$54.35	\$543.47
1991	\$3,069	\$1,535	\$61.39	\$675.25
1992	\$3,499	\$1,750	\$69.99	\$839.84
1993	\$3,797	\$1,898	\$75.93	\$987.13
1994	\$4,198	\$2,099	\$83.96	\$1,175.44
1995	\$4,657	\$2,329	\$93.15	\$1,397.20
1996	\$5,347	\$2,673	\$106.93	\$1,710.93
1997	\$5,235	\$2,617	\$104.69	\$1,779.79
1998	\$5,523	\$2,761	\$110.45	\$1,988.16
1999	\$6,543	\$3,271	\$130.85	\$2,486.21
2000	\$5,701	\$2,850	\$114.01	\$2,280.27
2001	\$4,099	\$2,050	\$81.99	\$1,721.72
2002	\$4,667	\$2,334	\$93.35	\$2,053.63
2003	\$4,992	\$2,496	\$99.84	\$2,296.32
2004	\$5,431	\$2,715	\$108.61	\$2,606.72
			\$1,703.35	\$26,148.75

## Valuing Coca Cola's Brand Name

- If we just accumulate the advertising expenses over time, assuming that 50% is attributable to building up brand name, we get a value of \$ 26 billion.
- If we adjust the expenses for inflation, the value that we obtain for the brand name value is close to 50%.
- The two key problems with this approach are
  - Estimating the proportion of advertising that can be attributed to brand name building
  - Estimating the life of brand name as an asset

## b. Valuing Coca Cola's brand name: Generic comparison

	<i>Coca Cola</i>	<i>With Cott Margins</i>
Current Revenues =	\$21,962.00	\$21,962.00
Length of high-growth period	10	10
Reinvestment Rate =	50%	50%
Operating Margin (after-tax)	15.57%	5.28%
Sales/Capital (Turnover ratio)	1.34	1.34
Return on capital (after-tax)	20.84%	7.06%
Growth rate during period (g) =	10.42%	3.53%
Cost of Capital during period =	7.65%	7.65%
Stable Growth Period		
Growth rate in steady state =	4.00%	4.00%
Return on capital =	7.65%	7.65%
Reinvestment Rate =	52.28%	52.28%
Cost of Capital =	7.65%	7.65%
<b>Value of Firm =</b>	<b>\$79,611.25</b>	<b>\$15,371.24</b>

Value of brand name = \$79, 611 million - \$15,371 million = \$ 64,240 million

### c. Valuing Coca Cola's brand name: Relative Valuation

	<i>Coca Cola</i>	<i>Cott</i>
Market value of Equity	\$98,160	\$949
Debt	\$7,178	\$345
Cash	\$6,707	\$27
Enterprise Value	\$98,631	\$1,267
Sales	\$21,962	\$1,646
EBITDA	\$7,760	\$186
Capital Invested	\$16,406	\$775
<i>EV Multiples</i>		
EV/Sales	4.49	0.77
EV/EBITDA	12.71	6.81
EV/Capital Invested	6.01	1.63

Value of brand name =  $16,406 (6.01 - 1.63) = \$71,821$  million

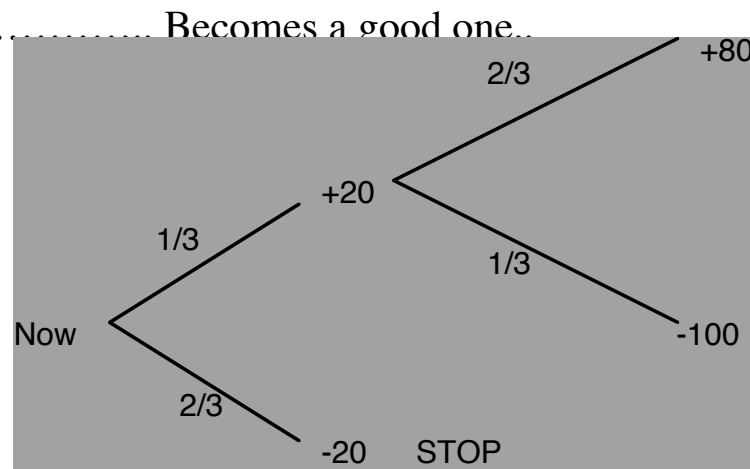
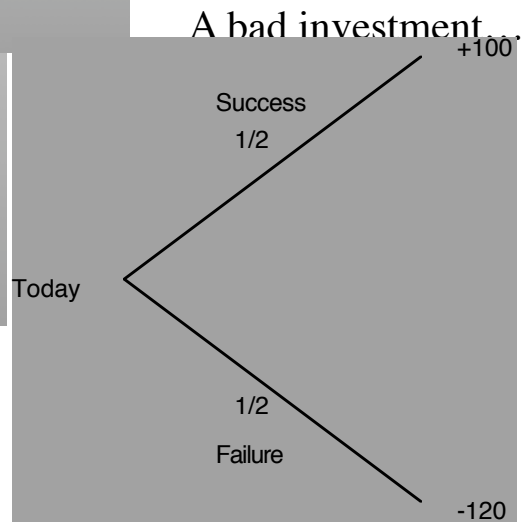


### III. Valuing intangible assets that do not generate cash flows now but might in the future....

- The most difficult intangible assets to value are those that have the potential to create cash flows in the future but do not right now. Examples would include:
  - Undeveloped patents
  - Undeveloped natural resource options
  - Flexibility to expand into new markets and businesses in the future
  - Flexibility to abandon investments, if they turn out to be losers.
- While these assets are difficult to value on a discounted cash flow valuation basis and often impossible to evaluate on a relative basis, they do have option characteristics and are best valued using option pricing models.

## A Real Option Premium

- In the last few years, there are some who have argued that discounted cashflow valuations under valued some companies and that a real option premium should be tacked on to DCF valuations. To understanding its moorings, compare the two trees below:



1. Learn at relatively low cost
2. Make better decisions based on learning

## Three Basic Questions

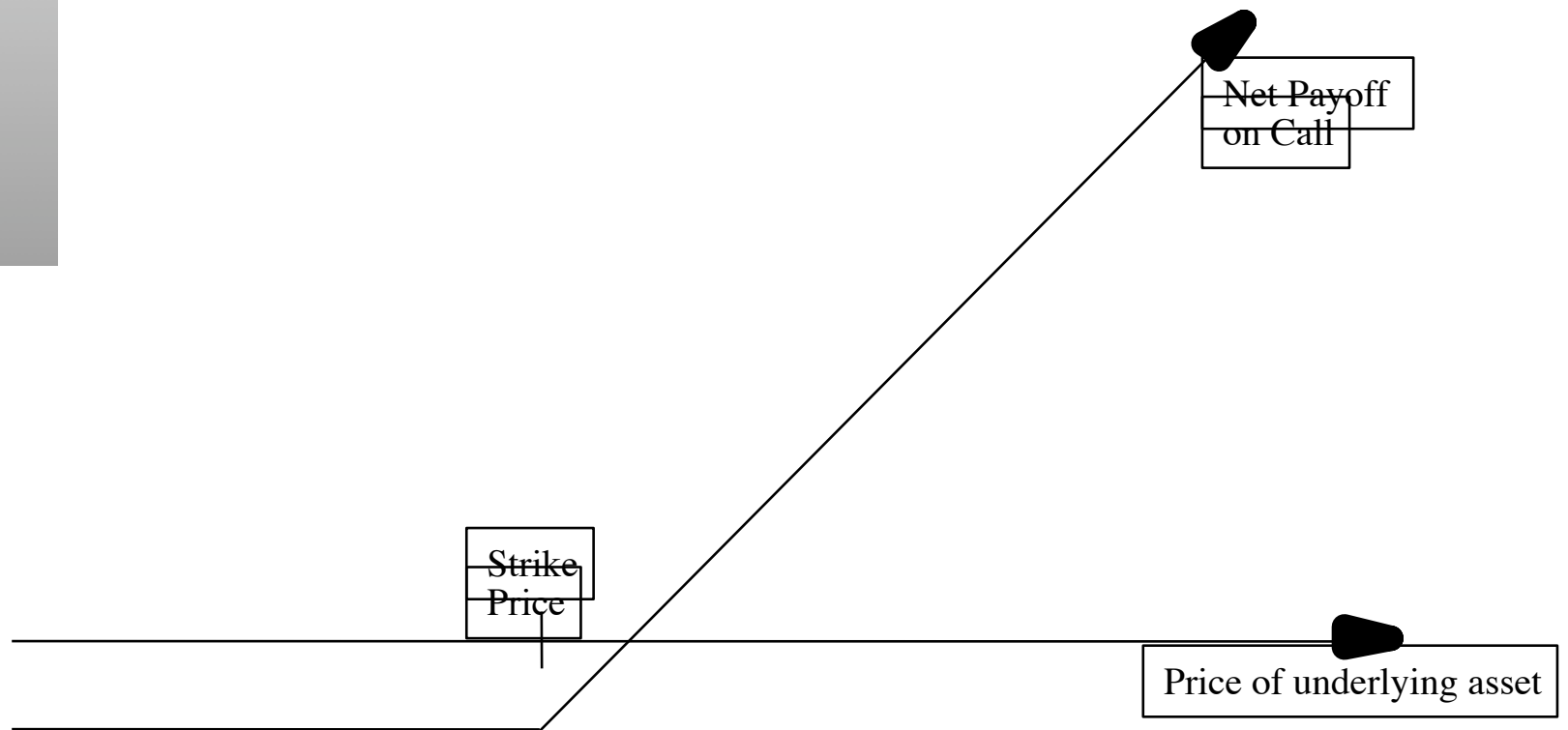
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- When is there a real option embedded in a decision or an asset?
- When does that real option have significant economic value?
- Can that value be estimated using an option pricing model?

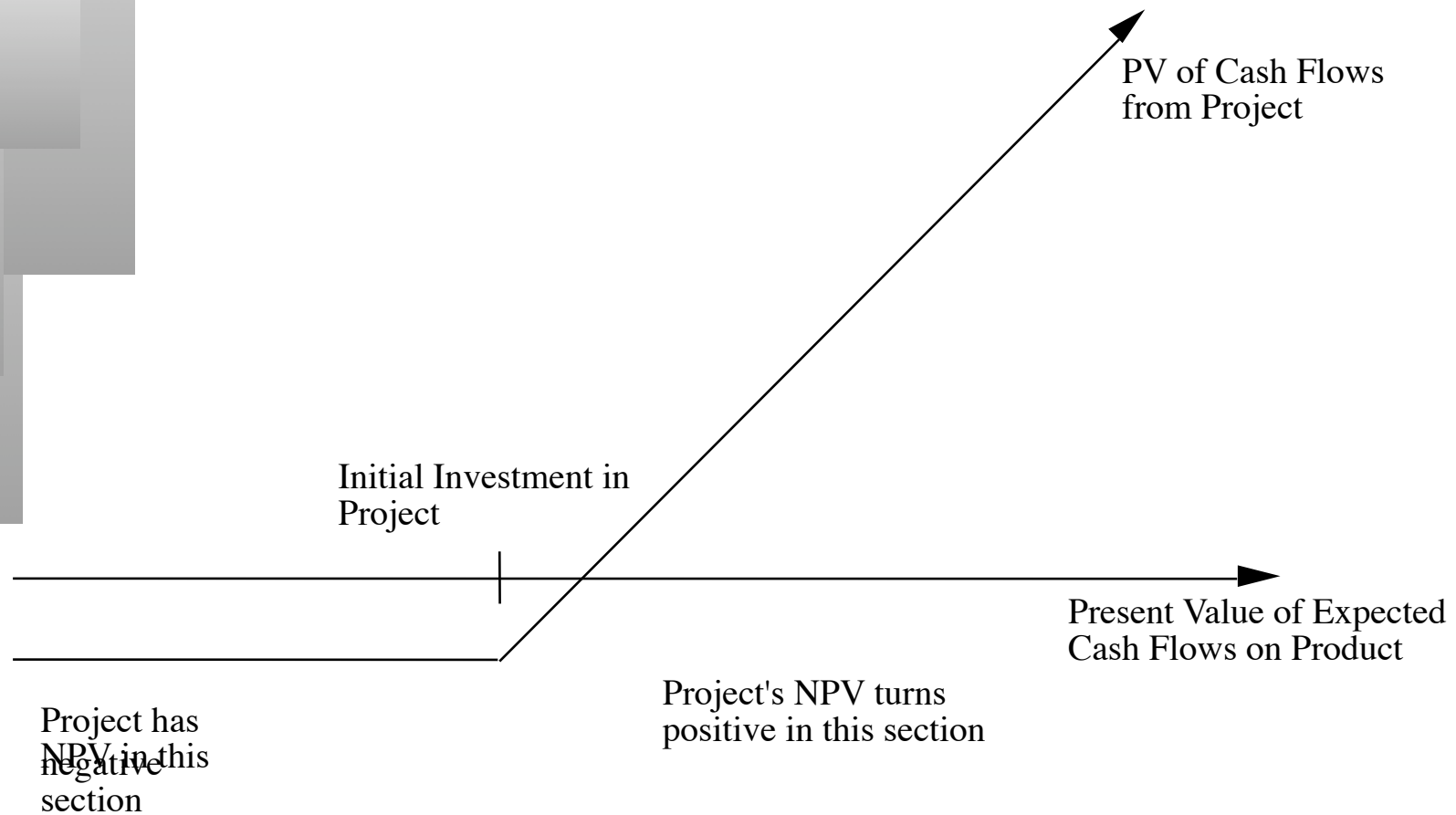
## When is there an option embedded in an action?

- 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.

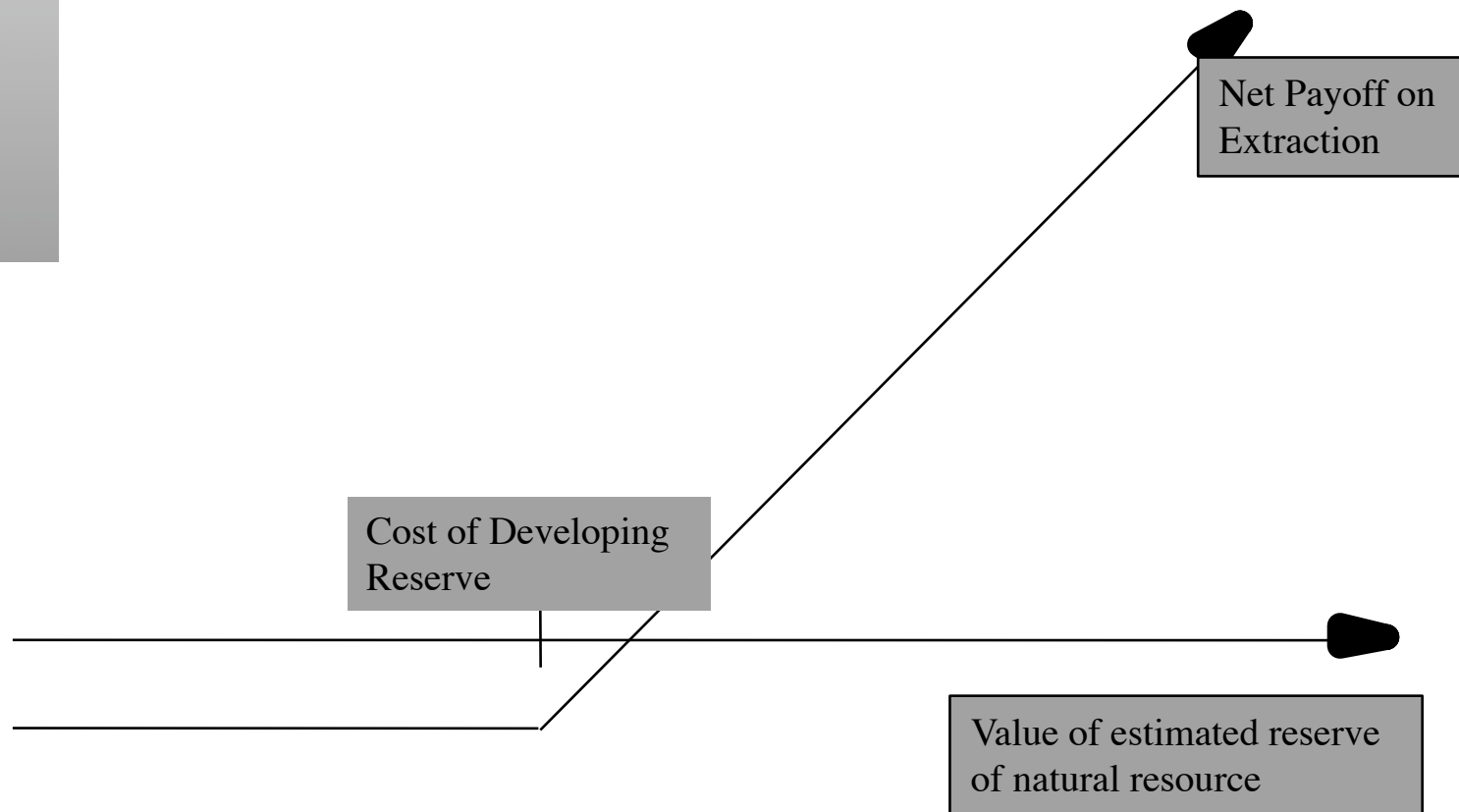
# Payoff Diagram on a Call



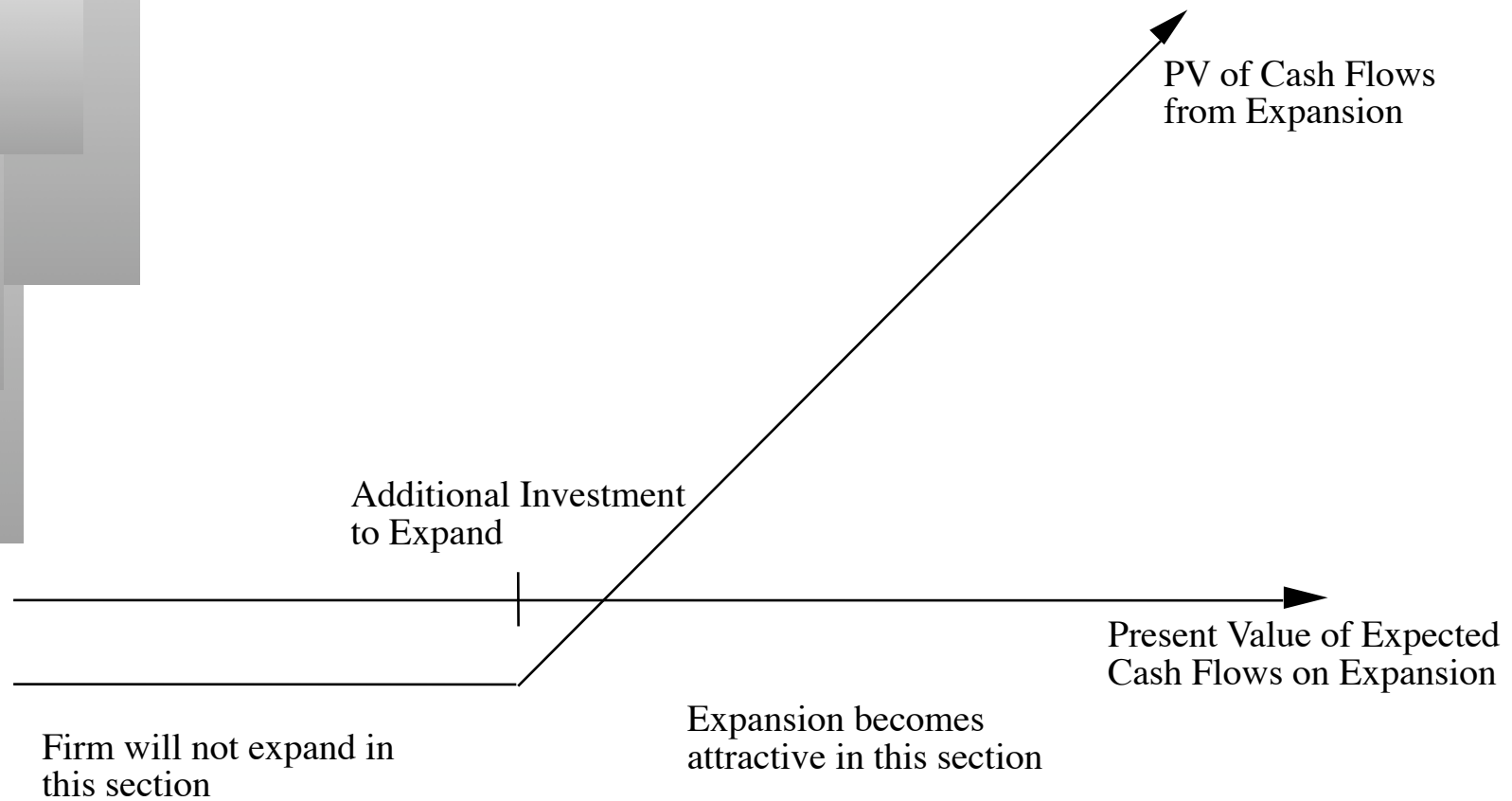
## Example 1: Product Patent as an Option



## Example 2: Undeveloped Oil Reserve as an option



## Example 3: Expansion of existing project as an option





## 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.

## Exclusivity: Putting Real Options to the Test

- **Product Options: Patent on a drug**
  - Patents restrict competitors from developing similar products
  - Patents do not restrict competitors from developing other products to treat the same disease.
- **Natural Resource options: An undeveloped oil reserve or gold mine.**
  - Natural resource reserves are limited.
  - It takes time and resources to develop new reserves
- **Growth Options: Expansion into a new product or market**
  - Barriers may range from strong (exclusive licenses granted by the government - as in telecom businesses) to weaker (brand name, knowledge of the market) to weakest (first mover).

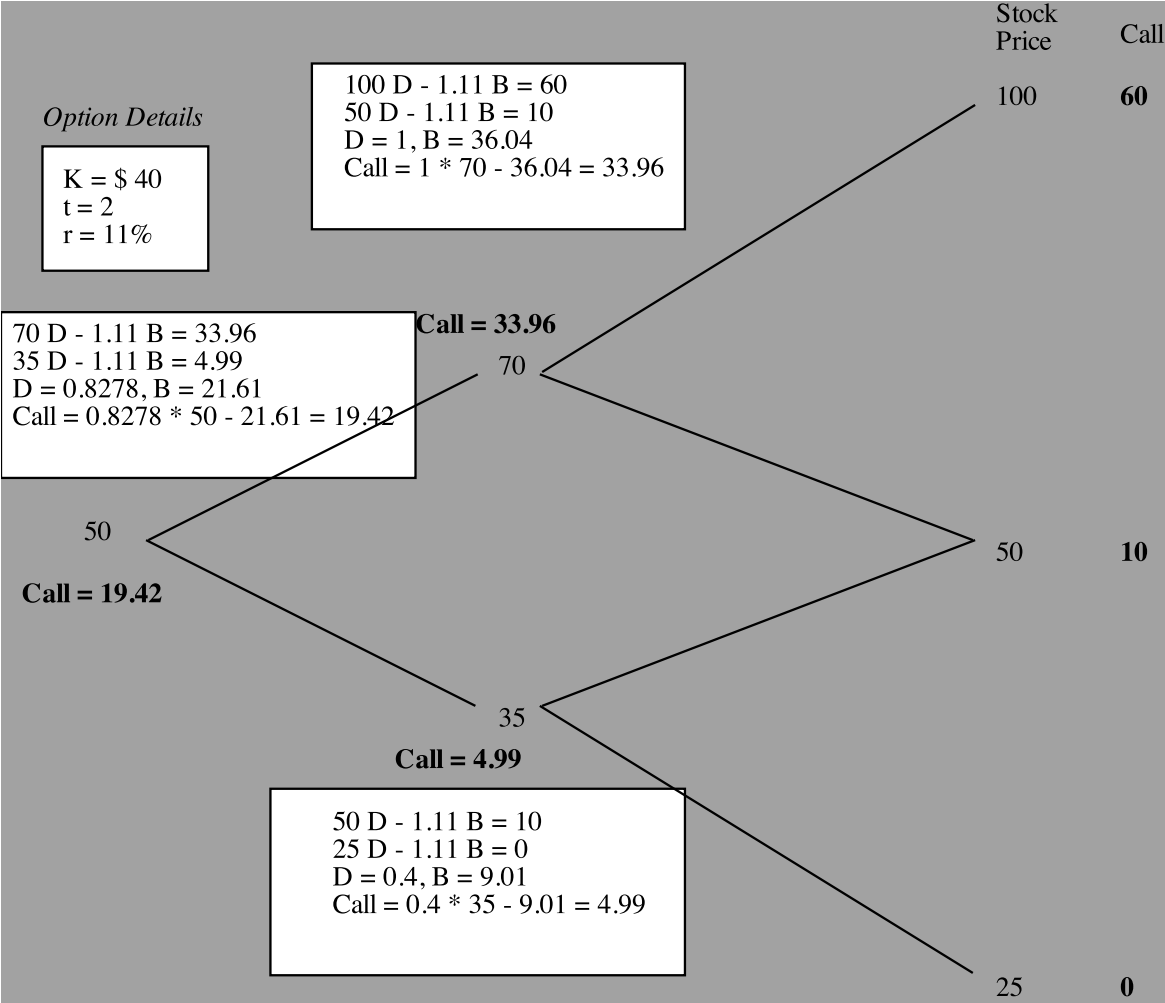
# Determinants of option value

- 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.

# The Building Blocks for Option Pricing Models: Arbitrage and Replication

- 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  $\Delta$  of the Underlying Stock
  - Put = Selling Short  $\Delta$  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



## The Limiting Distributions....

- 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.

## The Black Scholes Model

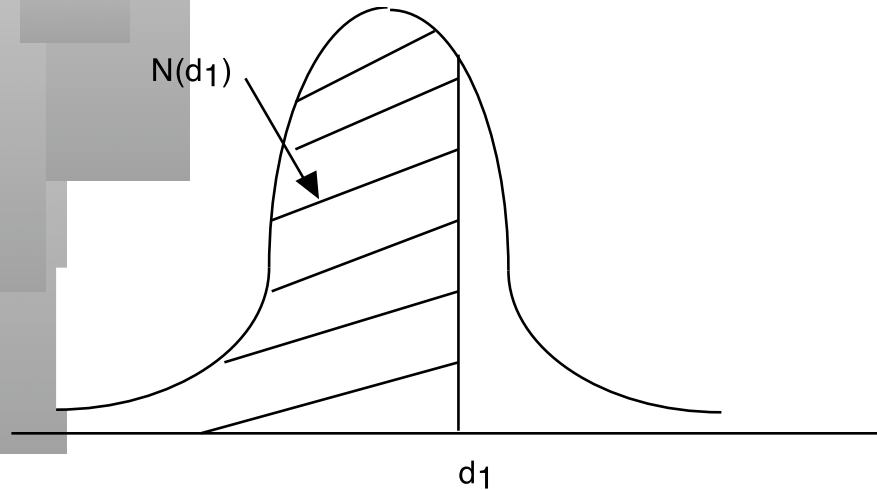
$$\text{Value of call} = S N(d_1) - K e^{-rt} N(d_2)$$

where,

$$d_1 = \frac{\ln\left(\frac{S}{K}\right) + \left(r + \frac{\sigma^2}{2}\right) t}{\sigma \sqrt{t}}$$

- $d_2 = d_1 - \sigma \sqrt{t}$
- The replicating portfolio is embedded in the Black-Scholes model. To replicate this call, you would need to
  - Buy  $N(d_1)$  shares of stock;  $N(d_1)$  is called the option delta
  - Borrow  $K e^{-rt} N(d_2)$

# The Normal Distribution



d	N(d)	d	N(d)	d	N(d)
-3.00	0.0013	-1.00	0.1587	1.05	0.8531
-2.95	0.0016	-0.95	0.1711	1.10	0.8643
-2.90	0.0019	-0.90	0.1841	1.15	0.8749
-2.85	0.0022	-0.85	0.1977	1.20	0.8849
-2.80	0.0026	-0.80	0.2119	1.25	0.8944
-2.75	0.0030	-0.75	0.2266	1.30	0.9032
-2.70	0.0035	-0.70	0.2420	1.35	0.9115
-2.65	0.0040	-0.65	0.2578	1.40	0.9192
-2.60	0.0047	-0.60	0.2743	1.45	0.9265
-2.55	0.0054	-0.55	0.2912	1.50	0.9332
-2.50	0.0062	-0.50	0.3085	1.55	0.9394
-2.45	0.0071	-0.45	0.3264	1.60	0.9452
-2.40	0.0082	-0.40	0.3446	1.65	0.9505
-2.35	0.0094	-0.35	0.3632	1.70	0.9554
-2.30	0.0107	-0.30	0.3821	1.75	0.9599
-2.25	0.0122	-0.25	0.4013	1.80	0.9641
-2.20	0.0139	-0.20	0.4207	1.85	0.9678
-2.15	0.0158	-0.15	0.4404	1.90	0.9713
-2.10	0.0179	-0.10	0.4602	1.95	0.9744
-2.05	0.0202	-0.05	0.4801	2.00	0.9772
-2.00	0.0228	0.00	0.5000	2.05	0.9798
-1.95	0.0256	0.05	0.5199	2.10	0.9821
-1.90	0.0287	0.10	0.5398	2.15	0.9842
-1.85	0.0322	0.15	0.5596	2.20	0.9861
-1.80	0.0359	0.20	0.5793	2.25	0.9878
-1.75	0.0401	0.25	0.5987	2.30	0.9893
-1.70	0.0446	0.30	0.6179	2.35	0.9906
-1.65	0.0495	0.35	0.6368	2.40	0.9918
-1.60	0.0548	0.40	0.6554	2.45	0.9929
-1.55	0.0606	0.45	0.6736	2.50	0.9938
-1.50	0.0668	0.50	0.6915	2.55	0.9946
-1.45	0.0735	0.55	0.7088	2.60	0.9953
-1.40	0.0808	0.60	0.7257	2.65	0.9960
-1.35	0.0885	0.65	0.7422	2.70	0.9965
-1.30	0.0968	0.70	0.7580	2.75	0.9970
-1.25	0.1056	0.75	0.7734	2.80	0.9974
-1.20	0.1151	0.80	0.7881	2.85	0.9978
-1.15	0.1251	0.85	0.8023	2.90	0.9981
-1.10	0.1357	0.90	0.8159	2.95	0.9984
-1.05	0.1469	0.95	0.8289	3.00	0.9987
-1.00	0.1587	1.00	0.8413		



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

- 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.

## Valuing a Product Patent as an option: Avonex

- Biogen, a bio-technology firm, has a patent on Avonex, a drug to treat multiple sclerosis, for the next 17 years, and it plans to produce and sell the drug by itself. The key inputs on the drug are as follows:

PV of Cash Flows from Introducing the Drug Now =  $S = \$ 3.422$  billion

PV of Cost of Developing Drug for Commercial Use =  $K = \$ 2.875$  billion

Patent Life =  $t = 17$  years    Riskless Rate =  $r = 6.7\%$  (17-year T.Bond rate)

Variance in Expected Present Values =  $\sigma^2 = 0.224$  (Industry average firm variance for bio-tech firms)

Expected Cost of Delay =  $y = 1/17 = 5.89\%$

$d1 = 1.1362$      $N(d1) = 0.8720$

$d2 = -0.8512$      $N(d2) = 0.2076$

Call Value =  $3,422 \exp^{(-0.0589)(17)} (0.8720) - 2,875 (\exp^{(-0.067)(17)} (0.2076)) = \$ 907$   
million

## Valuing an Oil Reserve

- Consider an offshore oil property with an estimated oil reserve of 50 million barrels of oil, where the cost of developing the reserve is \$ 600 million today.
- The firm has the rights to exploit this reserve for the next twenty years and the marginal value per barrel of oil is \$12 per barrel currently (Price per barrel - marginal cost per barrel). There is a 2 year lag between the decision to exploit the reserve and oil extraction.
- Once developed, the net production revenue each year will be 5% of the value of the reserves.
- The riskless rate is 8% and the variance in  $\ln(\text{oil prices})$  is 0.03.

## Valuing an oil reserve as a real option

- Current Value of the asset =  $S$  = Value of the developed reserve discounted back the length of the development lag at the dividend yield =  $\$12 * 50 / (1.05)^2 = \$ 544.22$
- (If development is started today, the oil will not be available for sale until two years from now. The estimated opportunity cost of this delay is the lost production revenue over the delay period. Hence, the discounting of the reserve back at the dividend yield)
- Exercise Price = Present Value of development cost =  $\$12 * 50 = \$600$  million
- Time to expiration on the option = 20 years
- Variance in the value of the underlying asset = 0.03
- Riskless rate = 8%
- Dividend Yield = Net production revenue / Value of reserve = 5%

## Valuing the Option

- Based upon these inputs, the Black-Scholes model provides the following value for the call:

$$d1 = 1.0359 \quad N(d1) = 0.8498$$

$$d2 = 0.2613 \quad N(d2) = 0.6030$$

- Call Value =  $544.22 \exp^{(-0.05)(20)} (0.8498) - 600 (\exp^{(-0.08)(20)} (0.6030)) = \$ 97.08$  million
- This oil reserve, though not viable at current prices, still is a valuable property because of its potential to create value if oil prices go up.
- Extending this concept, the value of an oil company can be written as the sum of three values:

$$\begin{aligned} \text{Value of oil company} &= \text{Value of developed reserves (DCF valuation)} \\ &+ \text{Value of undeveloped reserves (Valued as option)} \end{aligned}$$

## An Example of an Expansion Option

- Ambev is considering introducing a soft drink to the U.S. market. The drink will initially be introduced only in the metropolitan areas of the U.S. and the cost of this “limited introduction” is \$ 500 million.
- A financial analysis of the cash flows from this investment suggests that the present value of the cash flows from this investment to Ambev will be only \$ 400 million. Thus, by itself, the new investment has a **negative NPV of \$ 100 million.**
- If the initial introduction works out well, Ambev **could go ahead with a full-scale introduction to the entire market with an additional investment of \$ 1 billion** any time over the next 5 years. While the current expectation is that the cash flows from having this investment is only \$ 750 million, there is considerable uncertainty about both the potential for the drink, leading to significant variance in this estimate.

## Valuing the Expansion Option

- Value of the Underlying Asset (S) = PV of Cash Flows from Expansion to entire U.S. market, if done now = \$ 750 Million
- Strike Price (K) = Cost of Expansion into entire U.S market = \$ 1000 Million
- We estimate the standard deviation in the estimate of the project value by using the annualized standard deviation in firm value of publicly traded firms in the beverage markets, which is approximately 34.25%.
  - Standard Deviation in Underlying Asset's Value = 34.25%
- Time to expiration = Period for which expansion option applies = 5 years

**Call Value= \$ 234 Million**