

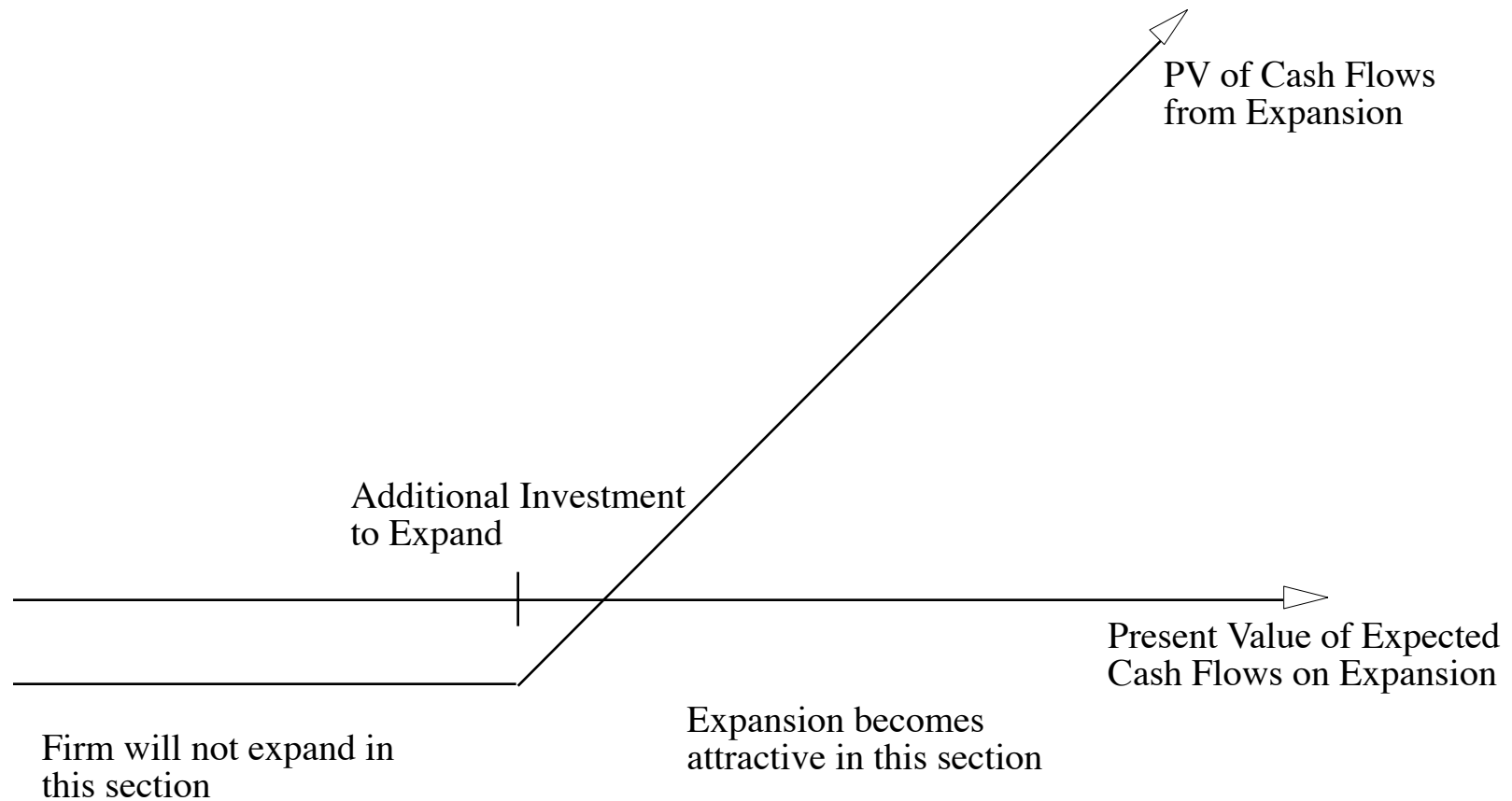
## The Option to Expand/Take Other Projects

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- Taking a project today may allow a firm to consider and take other valuable projects in the future.
- Thus, even though a project may have a negative NPV, it may be a project worth taking if the option it provides the firm (to take other projects in the future) provides a more-than-compensating value.
- These are the options that firms often call “strategic options” and use as a rationale for taking on “negative NPV” or even “negative return” projects.

# The Option to Expand

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## An Example of an Expansion Option

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- 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

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- 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

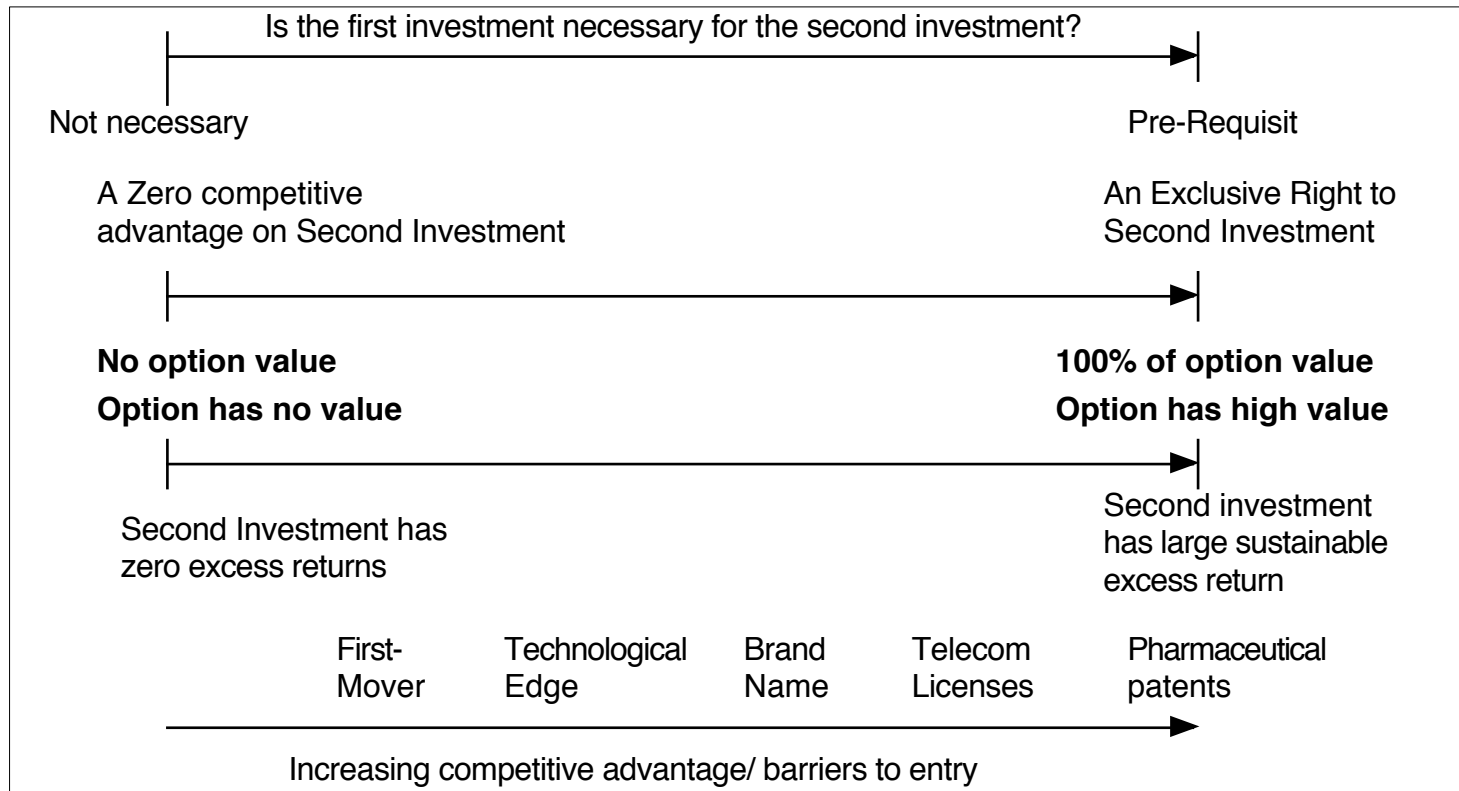
**Call Value= \$ 234 Million**

## Considering the Project with Expansion Option

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- NPV of Limited Introduction = \$ 400 Million - \$ 500 Million  
= - \$ 100 Million
- Value of Option to Expand to full market= \$ 234 Million
- NPV of Project with option to expand  
= - \$ 100 million + \$ 234 million  
= \$ 134 million
- **Invest in the project**

# Opportunities are not Options...



# The Real Options Test for Expansion Options

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- The Options Test
  - Underlying Asset: Expansion Project
  - Contingency

If PV of CF from expansion > Expansion Cost: PV - Expansion Cost  
If PV of CF from expansion < Expansion Cost: 0
- The Exclusivity Test
  - Barriers may range from strong (exclusive licenses granted by the government) to weaker (brand name, knowledge of the market) to weakest (first mover).
- The Pricing Test
  - Underlying Asset: As with patents, there is no trading in the underlying asset and you have to estimate value and volatility.
  - Option: Licenses are sometimes bought and sold, but more diffuse expansion options are not.
  - Cost of Exercising the Option: Not known with any precision and may itself evolve over time as the market evolves.
- Using option pricing models to value expansion options will not only yield extremely noisy estimates, but may attach inappropriate premiums to discounted cashflow estimates.

# Internet Firms as Options

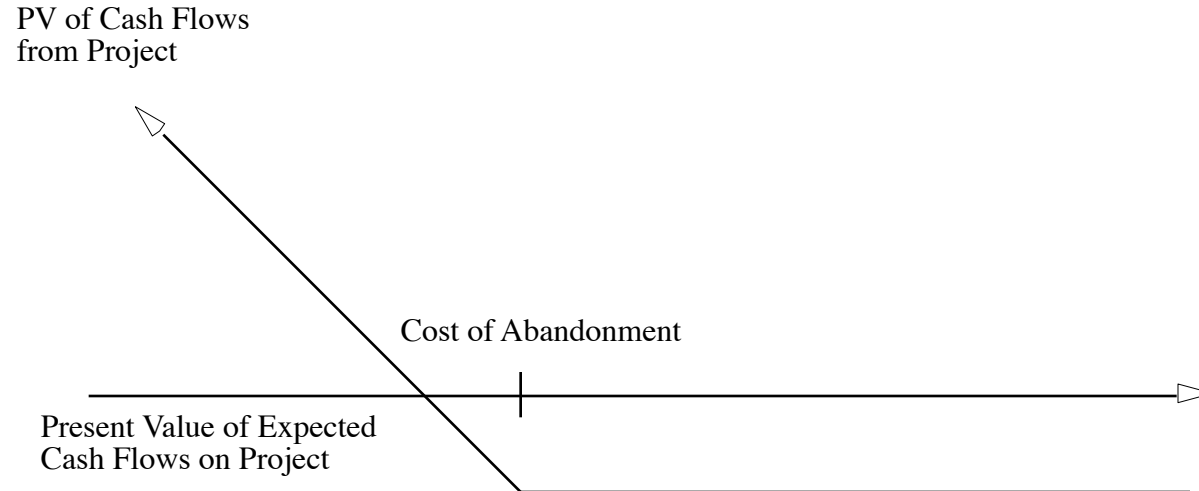
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- Some analysts have justified the valuation of internet firms on the basis that you are buying the option to expand into a very large market.  
What do you think of this argument?
  - Is there an option to expand embedded in these firms?
  - Is it a valuable option?

## The Option to Abandon

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- A firm may sometimes have the option to abandon a project, if the cash flows do not measure up to expectations.
- If abandoning the project allows the firm to save itself from further losses, this option can make a project more valuable.



## Valuing the Option to Abandon

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- Airbus is considering a joint venture with Lear Aircraft to produce a small commercial airplane (capable of carrying 40-50 passengers on short haul flights)
  - Airbus will have to invest \$ 500 million for a 50% share of the venture
  - Its share of the present value of expected cash flows is 480 million.
- Lear Aircraft, which is eager to enter into the deal, offers to buy Airbus' s 50% share of the investment anytime over the next five years for \$ 400 million, if Airbus decides to get out of the venture.
- A simulation of the cash flows on this time share investment yields a variance in the present value of the cash flows from being in the partnership is 0.16.
- The project has a life of 30 years.

## Project with Option to Abandon

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- Value of the Underlying Asset (S) = PV of Cash Flows from Project  
= \$ 480 million
- Strike Price (K) = Salvage Value from Abandonment = \$ 400 million
- Variance in Underlying Asset's Value = 0.16
- Time to expiration = Life of the Project = 5 years
- Dividend Yield =  $1/\text{Life of the Project} = 1/30 = 0.033$  (We are assuming that the project's present value will drop by roughly  $1/n$  each year into the project)
- Assume that the five-year riskless rate is 6%. The value of the put option can be estimated as follows:

## Should Airbus enter into the joint venture?

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- Value of Put =  $Ke^{-rt} (1-N(d2)) - Se^{-yt} (1-N(d1))$   
=  $400 (\exp^{(-0.06)(5)} (1-0.4624) - 480 \exp^{(-0.033)(5)} (1-0.7882))$   
= \$ 73.23 million
- The value of this abandonment option has to be added on to the net present value of the project of -\$ 20 million, yielding a total net present value with the abandonment option of \$ 53.23 million.

## Implications for Investment Analysis/ Valuation

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- Having a option to abandon a project can make otherwise unacceptable projects acceptable.
- Other things remaining equal, you would attach more value to companies with
  - More cost flexibility, that is, making more of the costs of the projects into variable costs as opposed to fixed costs.
  - Fewer long-term contracts/obligations with employees and customers, since these add to the cost of abandoning a project.
- These actions will undoubtedly cost the firm some value, but this has to be weighed off against the increase in the value of the abandonment option.