IMPORTANT INFORMATION

Final Exam: **Wednesday, 28 April 2021 at 9:00 am**

- On-site exam ONLY
  - No remote exam
- Digital exam on Examplify
  - **90 minutes** long; 36 MCQs
  - Open book/notes
  - NO internet
  - Randomized order
  - NO backward navigation
- A laptop & 2 calculators

Students who are unable to write this final exam on-site must file for **special consideration** together with valid supporting documents

- NUS Business School's Board of Examiners will decide the appropriate resolutions in line with NUS guidelines

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IMPORTANT INFORMATION

Final Exam: **Wednesday, 28 April 2021 at 9:00 am**

NUS takes final examination very seriously.

- Logistical arrangements for the final examination handled by the Registrar's Office (RO).
- This includes the assignments of examination venues and student seats
- RO will provide relevant information in due course

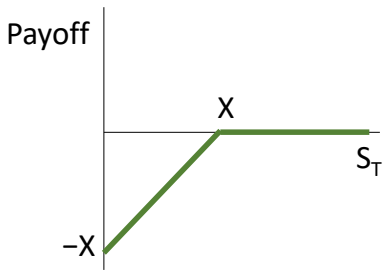
FIN2704/X
Week 12

Options

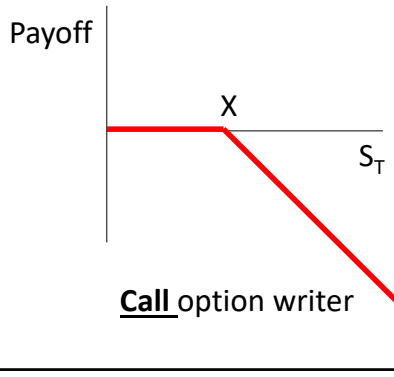
- Buyers/holders of options have the right (i.e., option) to exercise the option contract.
- Sellers/writers of options have the obligation to honor the exercise of the option contract.

Which one is riskier – put or call?

- As holders:
  - Both are risky because you can lose the premium
  - A reasonable strategy if you have informational advantage
  - Can also be used for hedging purpose
- As writers: Selling/writing call option is riskier than selling/writing put option.
  - There is an unlimited downside to selling/writing call option



Put option writer



Call option writer

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Payoff vs. profit (Example on slides 19 – 22)

Investment	Strategy	Investment	
(i) Equity only	Buy stock @ $100	100 shares	$10,000
(ii) Options only	Buy calls @ $10	1000 options	$10,000
(iii) T-Bills/Calls	Buy calls @ $10 Buy T-bills @ 3% Yield	100 options	$1,000 $9,000

Buyers paid 1000*$10 = $10,000 to purchase the call options

Investment VALUE Under 3 Scenarios of Stock Price at Expiration (S_T)

	(i) $70	(ii) $95	(iii) $105	(iv) $115	(v) $130
All Stock	$7000	$9,500	$10,500	$11,500	$13,000
All Call Options	$0	$0	$5,000	$15,000	$30,000
T-Bills/Calls	$9,270	$9,270	$9,770	$10,770	$12,270

Payoff when S_T = $105 is 1000*($105 − $100) = $5,000
Return = ($5,000 − $10,000)/$10,000 = −50%

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Side bet A example (slide 16)

This is an illustrative example of a bet whose payoff that is similar to a call option's payoff.

Side Bet A: (Cost of bet = $2)

You will be paid $1 for every empty seat in a stadium above 10 empty seats. If there are fewer than 10 empty seats, you will be paid $0.

- If there are more than 10 empty seats, your payoff = (number of empty seats − 10) * $1
  - Your nominal profit (without discounting) = the payoff − $2.
- If there are fewer than 10 empty seats, your payoff is $0
  - Your nominal profit will be −$2

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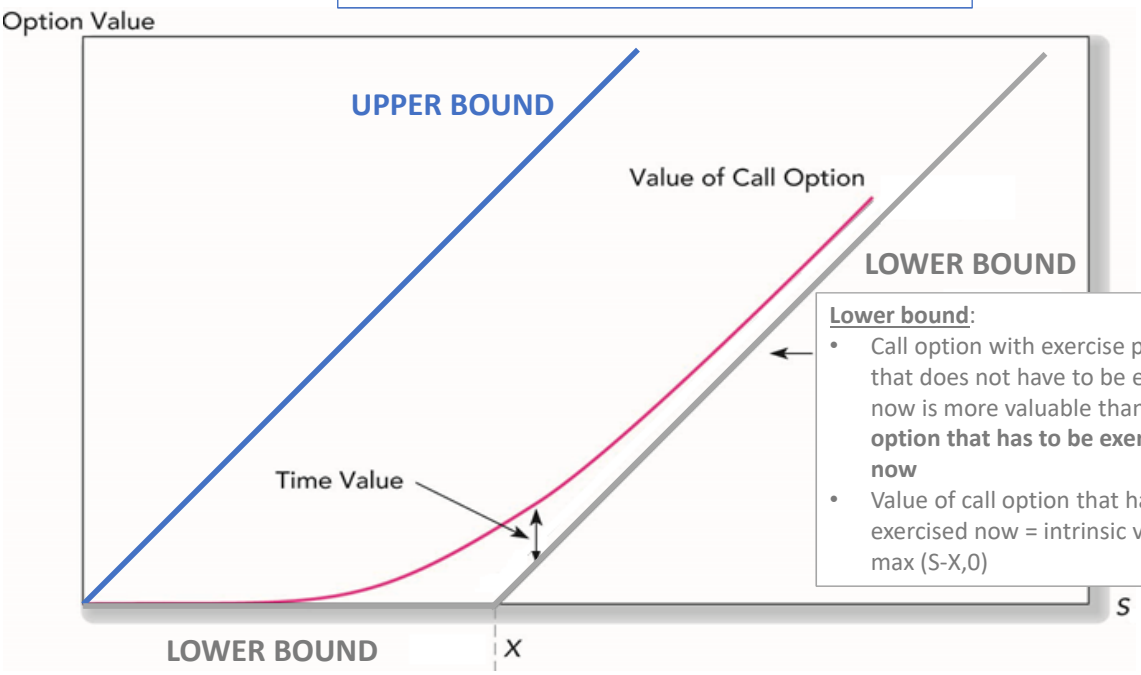
Options values

- Intrinsic value: the payoff of an option IF it was to be exercised now
- Time value of an option: the value of being able to wait to exercise an option, i.e., not being obligated to exercise now
  - NOT time value of money

- The example used is for call options
  - Similar derivation for put options
    - Upper bound: X
    - Lower bound: intrinsic value which is max(X-S,0)

Upper bound:
- Call option with exercise price X cannot be more valuable than **call option with exercise price 0**
- Call option with exercise price 0 = call option that requires no payment to exercise = (already) owning the stock itself.
  - Value = S (= the value of the stock)



Lower bound:
- Call option with exercise price X that does not have to be exercised now is more valuable than **call option that has to be exercised now**
- Value of call option that has to be exercised now = intrinsic value = max (S-X,0)

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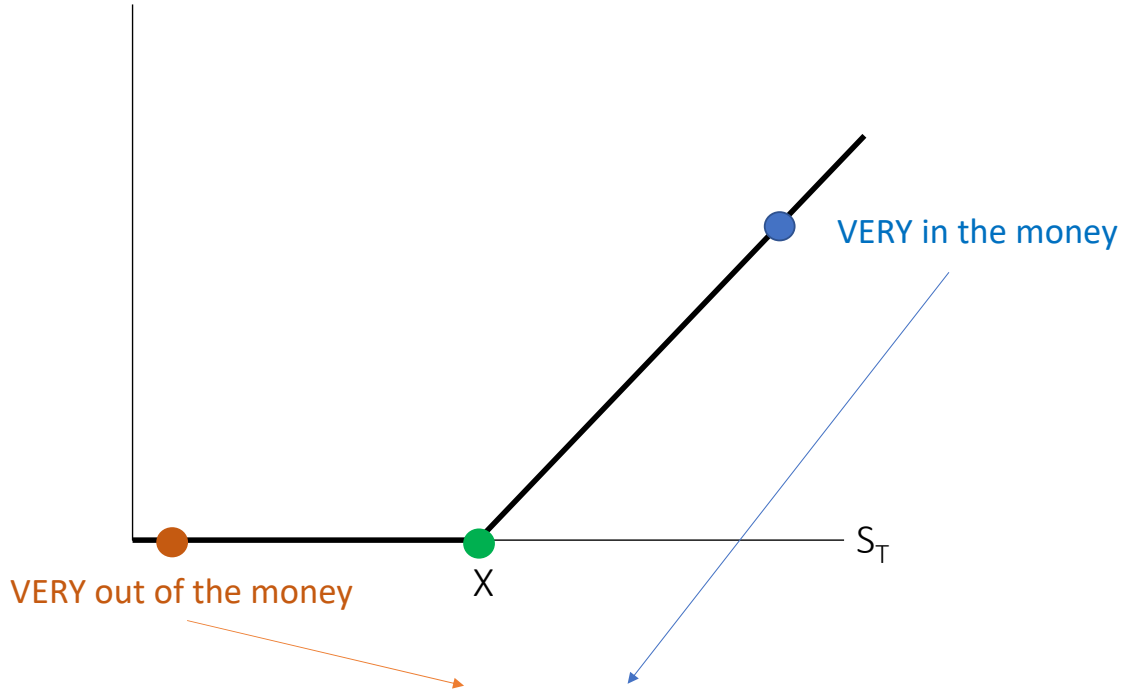

The value of the call option in the <u>extreme regions</u> are not affected by the volatility of the stock options because in these two regions you KNOW FOR SURE whether the option will be exercised or not.

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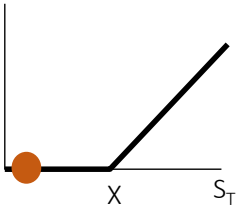
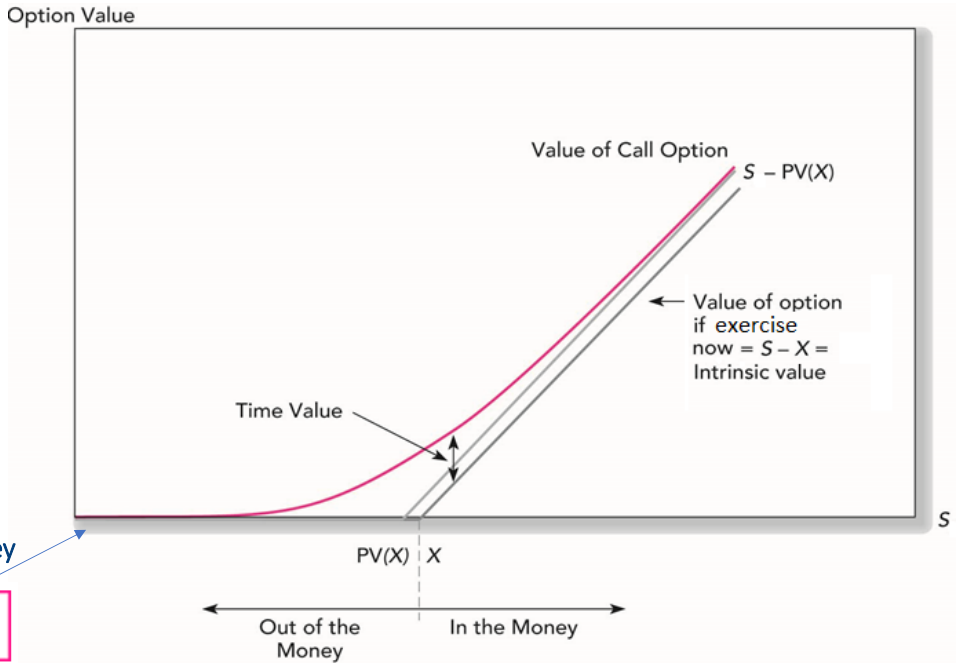


VERY out-of-the-money



VERY
Out-of-the-money

$C = 0$

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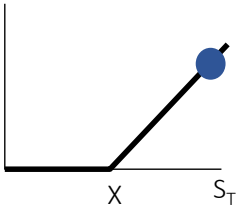
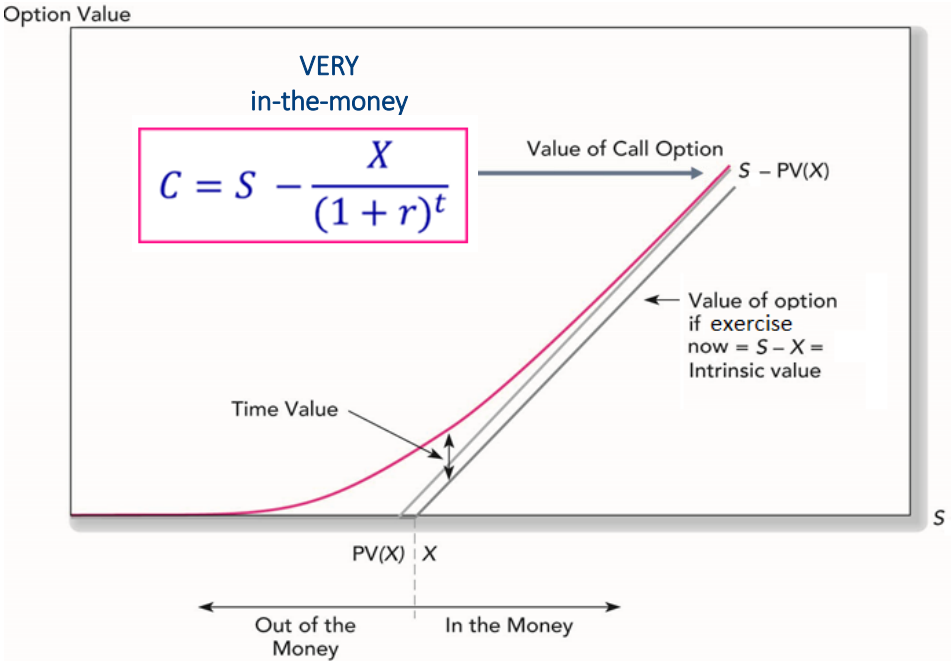


VERY in-the-money



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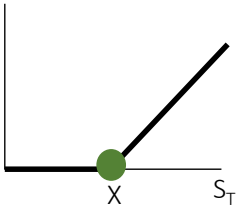
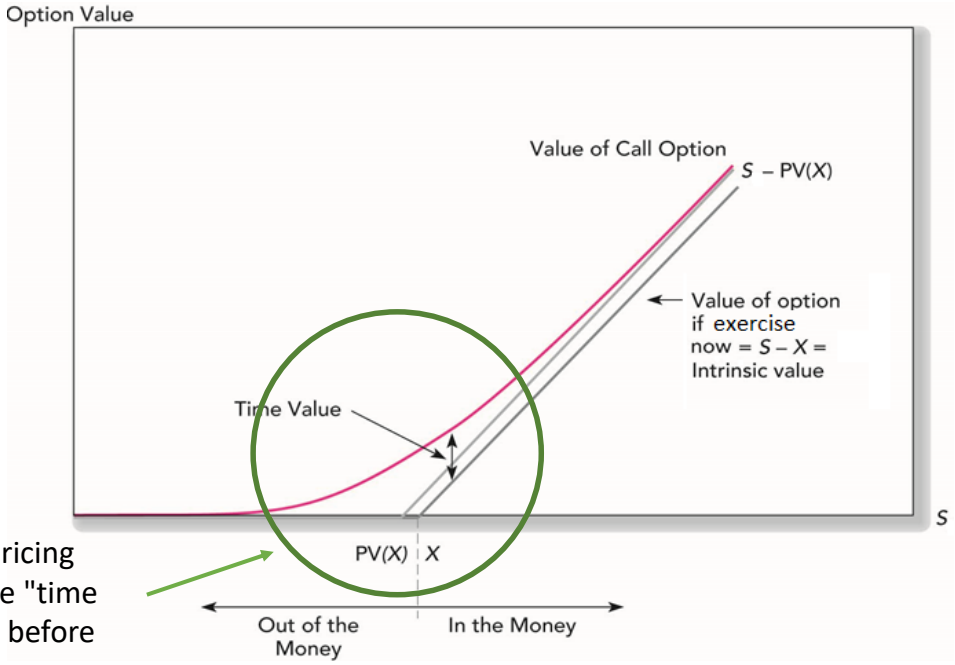


In-between



Requires an option pricing model to factor in the "time value" of the option, before expiration

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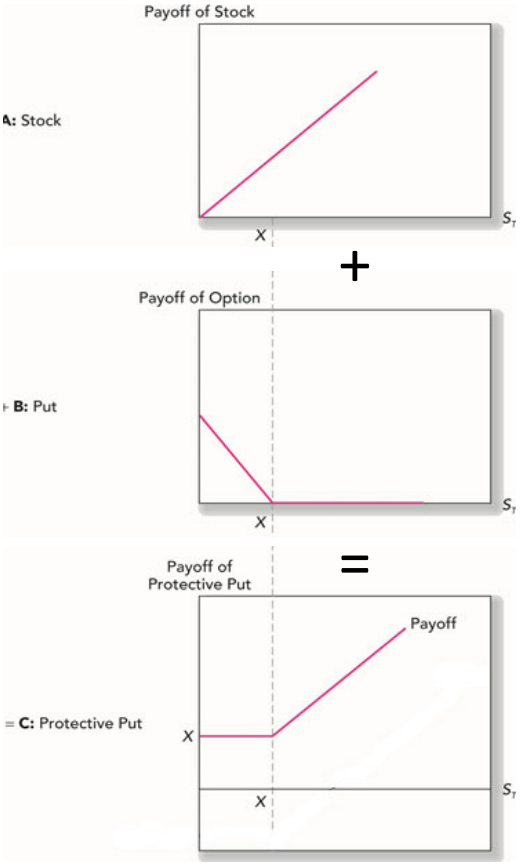
Put call parity

Investment 1:

Protective put:

- a stock position and
- a put option on that position



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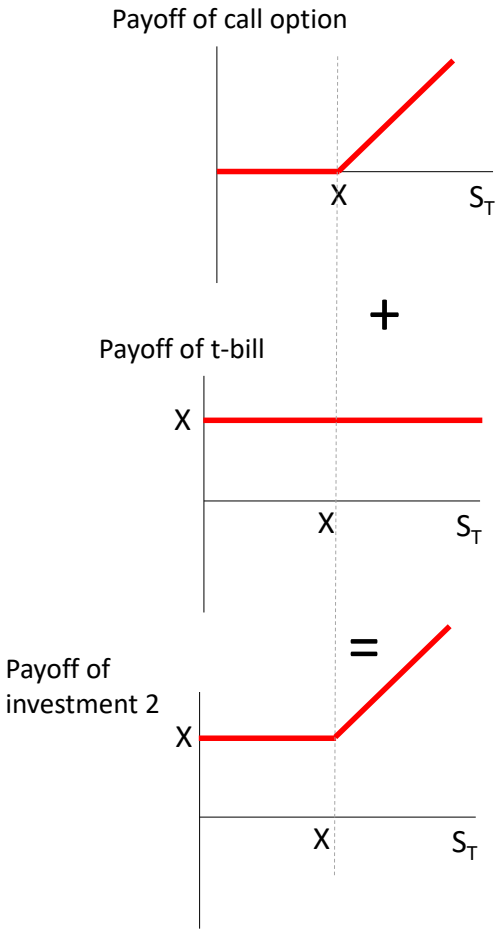
Put call parity

Investment 2:

- Buy a call option on the same stock and
- Treasury bills with face value equal to the exercise price

If two strategies have identical payoffs in the future, they must have identical value.

- They should have identical costs, allowing you to choose either strategy.



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Additional notes

Why do you exercise at $S_T - X > 0$

instead of $S_T - X -$ premium > 0?

- What buyers have paid in premium to purchase the options is sunk when they need to make the exercise decision
- You should exercise if $S_T - X > 0$
  - You can generate positive payoff at exercise
  - Buy at X, sell at S_T (>X)
  - If $S_T - X -$ premium < 0, you will have negative profit (i.e., loss), but exercising will reduce the loss

Week 12
List of topics

Note:

You are responsible for all materials covered in the pre-recorded videos posted on LumiNUS, unless they are marked "not examinable". This list only serves to help you in your revisions.

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Week 12 topics

<u>Options</u>

- Derivative instruments
- Call options vs. Put options
- European options vs. American options

- Options terminology:
  - Buy/hold
  - Sell/write
  - Call option: buyer/holder vs. seller/writer
  - Put option: buyer/holder vs. seller/writer

Week 12 topics (cont.)

- Options notations:
  - S_0 – price of the underlying asset today
  - S_T – price of the underlying asset at option's expiration date
  - X – strike price of the option
  - T – expiration date of the option
  - r – interest rate (risk-free rate)
  - C_0 – price of a call option today
  - C_T – value of a call option at the option's expiration date
  - P_0 – price of a put option today
  - P_T – value of a put option at the option's expiration date

Week 12 topics (cont.)

- Payoff at maturity
  - In the money
  - At the money
  - Out of the money
- Put call parity
- Option values
  - Intrinsic value
  - Time value
  - Upper bound vs. lower bound

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