

Options: Basics and Strategies

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Overview

- Option basics
 - Option valuation on expiration date
 - Option strategies
- Next two classes: Option valuation prior to expiration date
 - No-arbitrage bounds on option prices
 - Black-Scholes-Merton Formula

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Option Basics

- Derivatives
- Option characteristics
- Value of options at expiration
- Option strategies

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Derivatives

- A **derivative** is a security with a payoff that depends on the price of another security



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Derivatives

- A **derivative** is a security with a payoff that depends on the price of another security
- The other security is called the **underlying** (security)
- Examples: options, futures, swaps.

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Swaps

Definition:

- A swap is an exchange of cash flows, CFs.
- It is a legal arrangement between two parties to exchange specific payments.

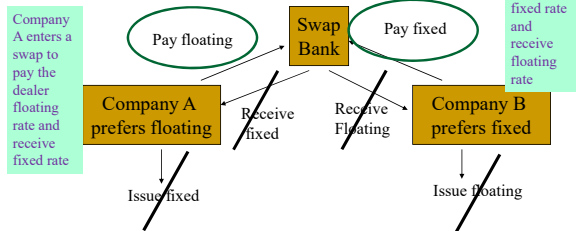
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Interest Rate Swaps: Types

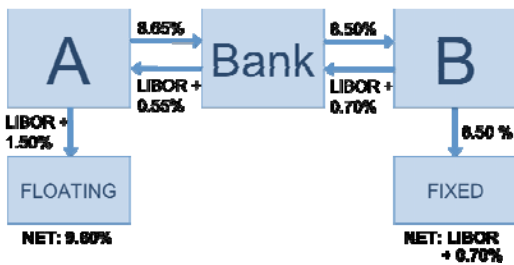
- There are four types of swaps:
 1. **Interest Rate Swaps:** Exchange of fixed-rate payments for floating-rate payments
 2. **Currency Swaps:** Exchange of liabilities in different currencies
 3. **Cross-Currency Swaps:** Combination of Interest rate and Currency swap
 4. **Credit Default Swaps:** Exchange of premium payments for default protection

Interest Rate Swap - example

- Company A issue fixed bond but prefer to pay floating w
Company B issue floating and prefer to pay fixed....



Interest Rate Swap



Derivatives

- A **derivative** is a security with a payoff that depends on the price of another security
- The other security is called the **underlying** (security)
- Examples: options, futures, swaps.
- Derivatives are used for
 - Risk management, hedging
 - Executive compensation
 - Portfolio insurance
 - Speculation

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Options -Basic Concepts

- **Call option-**
 - Giving the holder the right to buy an asset by a certain day for a certain price.
- **Put option-**
 - Giving the holder the right to sell an asset by a certain day for a certain price.

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Options Characteristics

- Option types
 - **Call** option: **right to Buy** underlying at a predetermined ex. price
 - **Put** option: **right to Sell** underlying at a predetermined ex. price
- Exercise price / strike price (**X**)
- Can exercise at or before expiration (**T**)
 - European: exercise only at expiration
 - American: exercise any time at or before expiration
- Price or premium
- In-the-money, out-of-the-money, at-the-money
$$S_0 > X \quad S_0 < X \quad S_0 = X$$
- Net profit includes cost of option

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Value of Options at Expiration

- At expiration, if the stock price is S_T , a **Call** option with strike price X is worth:

$$C_T = \begin{cases} S_T - X & \text{if } S_T > X \\ 0 & \text{if } S_T \leq X \end{cases}$$

- At expiration, if the stock price is S_T , a **Put** option with strike price X is worth:

$$P_T = \begin{cases} 0 & \text{if } S_T \geq X \\ X - S_T & \text{if } S_T < X \end{cases}$$

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Stock Option Logic

- Q: Why do you buy a call?**
- A: you expect the stock price to go up.
- Q But you could buy the stock outright?**
- A: A call is sometimes a better vehicle because it gives you downside protection. You think the stock will go up, but you are worried it may go down. You **protect against the downside**. The option payoff is not symmetric, the stock payoff is symmetric. It has an **unlimited downside**.
- Q: Can you replicate the call option payoff with a position in the stock only?**
- A: Long in stock with stop loss at 100. This is a dynamic trading strategy (repeated buying and selling) that replicates the call option payoff. Problem: price may jump (event risk)

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The Value of a Call at Expiration

- Payoff and net profit for a call option with a strike/ exercise price of $X=\$100$ and premium of $\$10$.

S_T	80	90	100	110	120	130
Payoff						

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The Value of a Call at Expiration

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The Value of a Call at Expiration

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S_T	80	90	100	110	120	130
Payoff	0	0	0	10	20	30
Profit						

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Profit	-10	-10	-10			

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The Value of a Call at Expiration

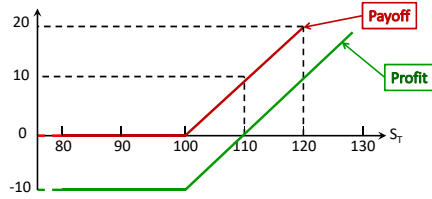
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Summary

	Call Option	Put Option
Long (buy)		

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Summary

	Call Option	Put Option
Long (buy)	You have the right to buy the underline asset for X (price) at a specific day.	

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Summary

	Call Option	Put Option
Long (buy)	You have the right to buy the underline asset for X (price) at a specific day.	You have the right to sell the underline asset for X (price) at a specific day

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Summary

	Call Option	Put Option
Long (buy)	You have the right to buy the underline asset for X (price) at a specific day.	You have the right to sell the underline asset for X (price) at a specific day
Short (write/sell)	You have the obligation to sell the underline asset for X (price) at a specific day if the call holder asked you to do so.	

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Summary

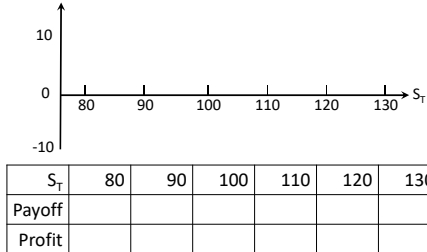
	Call Option	Put Option
Long (buy)	You have the right to buy the underline asset for X (price) at a specific day.	You have the right to sell the underline asset for X (price) at a specific day
Short (write/sell)	You have the obligation to sell the underline asset for X (price) at a specific day if the call holder asked you to do so.	You have the obligation to buy the underline asset for X (price) at a specific day if the put holder asked you to do so.

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DIY: Value of a Short Call at Expiration

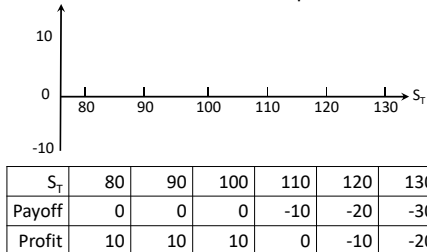
- Determine the payoff and net profit for a *short* a call with a strike of $X=\$100$ and premium of $\$10$



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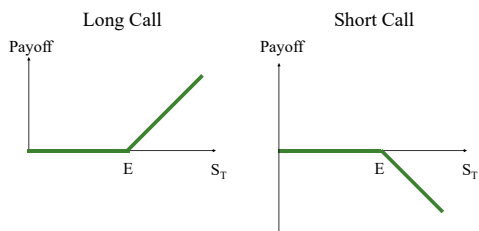
DIY: Value of a Short Call at Expiration

- Determine the payoff and net profit for a *short* a call with a strike of $X=\$100$ and premium of $\$10$



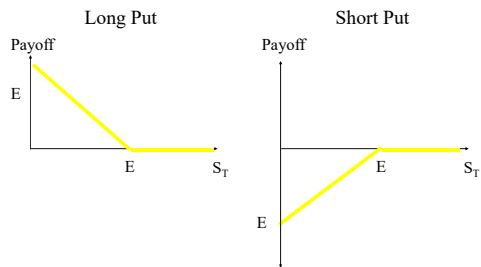
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Call Option Payoffs



How About Put?

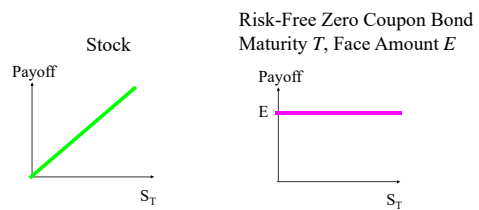
Put Option Payoffs



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Other Relevant Payoffs



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Concepts to Know

- Option basics
 - Call option
 - Put option
 - Draw payout profile

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