

# Options Part 1

Pritam Dalal

# Context

- ▶ *Options* are simple financial contracts that show up everywhere in finance.
- ▶ They can be viewed as the building blocks of many other financial instruments.
- ▶ The theory of option pricing is the starting point for much of quantitative finance.
- ▶ Most of the data that we are going to analyze in this class will be options related.
- ▶ **Bottom Line:** You need to understand options.

# Options are Insurance Contracts

- ▶ **Options** are simple **insurance** contracts wrapped around other financial assets.
- ▶ The financial asset that is being insured is called the *underlying*.
- ▶ The types of underlyings that we are going to discuss in this class will mostly be stocks and ETFs.
- ▶ The essential concepts are the same for other underlyings like interest rates, futures, or barrels of oil.
- ▶ Let's build some intuition using a type of insurance that you are all familiar with: car insurance.

# Wolve Auto Insurance

- ▶ Wolverine Trading wants to get into the car insurance business. They would like our help with formulating a pricing policy.
- ▶ The type of underlying they want to insure: a specific driver coupled with a specific vehicle.
- ▶ The driver being insured is going to pay Wolve *premium*.
- ▶ In exchange for premium, Wolve will reimburse the driver whenever damage to the car exceeds a certain dollar amount, called the *strike* (deductible).
- ▶ **Intuition Check:** Do you think Wolverine should charge the same premium irrespective of the underlying?

# Price of Underlying

- ▶ Sandra has two different vehicles that she wants to switch over to Wolve Auto insurance.
- ▶ One is an old busted Mazda 3 that she bought several years ago when she was a struggling MFM instructor.
- ▶ The other is a fancy new self-driving Tesla that she bought last week after starting her lucrative options trading career.
- ▶ **Intuition Check:** Which one should be more expensive to insure? Why?

# Strike Price of Contract

- ▶ Wolve Auto has three different strikes that they can offer Sandra for the insurance on her self-driving Tesla:
  - ▶ *at-the-money* := \$0
  - ▶ \$1,000
  - ▶ \$5,000
- ▶ **Exercise:** Order the premium for the three strike prices from cheapest to most expensive. Explain.

# Time to Expiration (Tenor) of Contract

- ▶ Wolve has three different contract lengths that they can offer Sandra for her Tesla insurance:
  - ▶ 0.25 years
  - ▶ 0.50 years
  - ▶ 1.00 years
- ▶ **Exercise:** Order the premium for these tenors from most expensive to least expensive. Explain.

# Volatility of Underlying

- ▶ Wolve is pricing insurance for two different customers, Sally and Patty.
- ▶ Both Sally and Patty are looking to purchase insurance a fancy new self-driving Tesla. They both want a 1-year contract with with a \$1,000 strike price.
- ▶ Here is how Sally's friends describe her: calm, chill, responsible, quiet, serene.
- ▶ Here is how Patty's friends describe her: wild, hyper, flakey, loud, volatile.
- ▶ **Intuition Check:** Who should Wolverine charge more for insurance? Why?

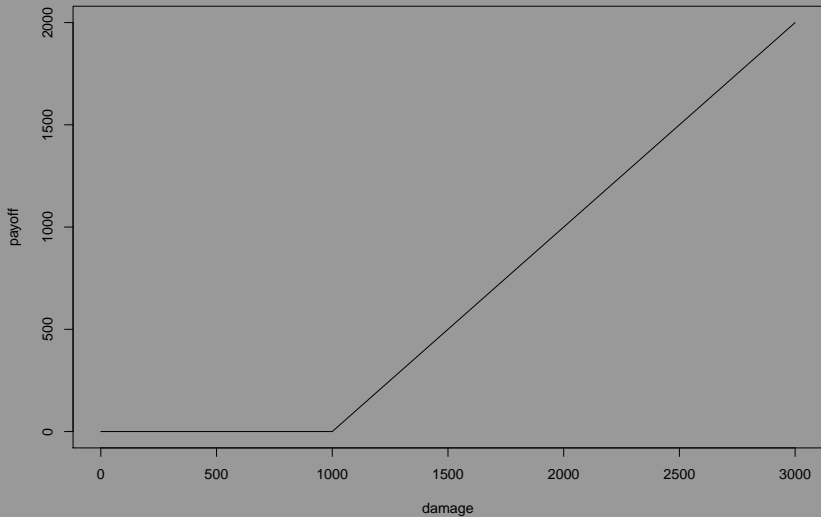


# Insurance Payoff Graph (1 of 3)

- ▶ It's 8a on a Saturday morning. Sally is driving on the freeway on her way to CrossFit, hands at 10-2, eyes on the road, listening to classical music.
- ▶ Patty, also driving on the freeway, is on her way home from an all night rave. As she is driving, she is blasting Bassnectar and posting to her IG story.
- ▶ Suddenly, Patty loses control and swerves in front Sally. . . (freeze tape)
- ▶ Patty is riding dirty with no insurance, but Sally purchased a \$1000-strike contract before she left the dealership.
- ▶ **Excercise:** Graph the value of Sally's insurance payoff as a function of the damage to her vehicle from the accident.

# Insurance Payoff Graph (2 of 3)

**Payoff to Sally**



# Insurance Payoff Graph (3 of 3)

- ▶ The payoff graph we created was from Sally's perspective.
- ▶ **Intuition Check:** What does the graph look like from Wolverine's perspective?
- ▶ **Jargon:** We say that Sally is long (bought) the insurance contract and that Wolverine is short (sold) the insurance contract.