FOS Masterclass

Quantitative Finance

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March 5, 2022

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What are my *options*?

- What are options?
- Who trades options and why?
- What is the “fair” value of an option?

Derivatives + Add to myFT

US options trading heats up even as speculative stock rally cools

Industry participants see 'no sign' US equities wobble has caused exodus from derivatives bets

Business

Meta slide drives 'insane' options volume as some bet on bounce

By Saqib Iqbal Ahmed

cna

Business

More online traders betting on options and futures, IG says

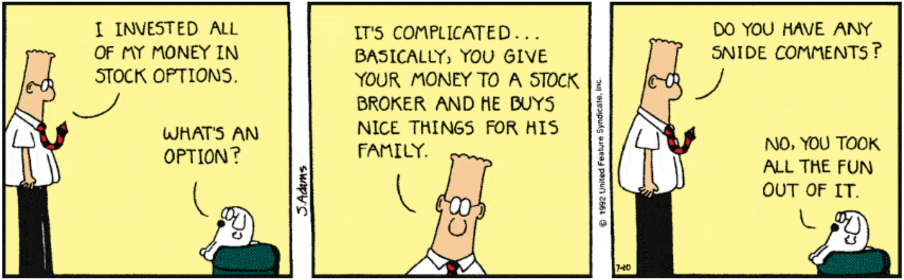
Exhibit 1: Single stock options trading volumes are bigger than shares volumes for the first time

Average daily notional traded for options vs the underlying stocks

Source: Goldman Sachs Global Investment Research, OptionMetrics, Data as of 21-July

By some measures, stock options are traded more than stocks themselves.

So what are options?



From Wikipedia:

"In finance, an option is a contract which conveys to its owner, the holder, the right, but not the obligation, to buy or sell an underlying asset or instrument at a specified strike price on or before a specified date, depending on the style of the option."

More slowly...

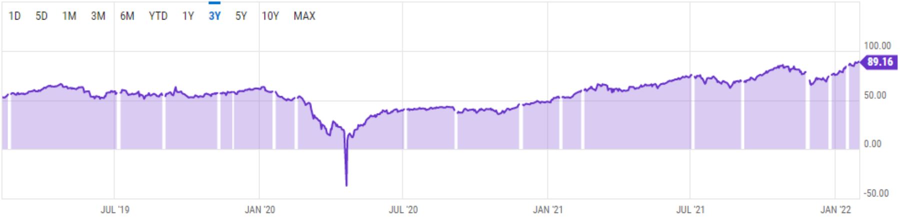
1. A (call) option is a contract between two entities.
    - Typically a company and an investment bank.
2. The contract specifies:
    - a type of asset, say a barrel of oil;
    - a future date, say June 5;
    - a strike price, say 90$.
3. The contract works as follows:
    - Today, the company pays the investment bank a certain fee.
    - In return, the investment bank guarantees that on June 5 the company will be able (but not obliged) to buy one barrel of oil for 90$.

A Scoot example

- You enrolled at NUS majoring in QF.
  Exams will be in April and May. It's gonna be hard work but you can do it.
- To have something to look forward to, you plan a vacation to Langkawi once exams are over.

- Scoot flight is 72.4S$. You buy the ticket today to fly on June 5!
- What are the costs for Scoot?

- Some costs are known: crew wages, maintenance, airport fees...
- But the cost of fuel can change a lot between now and June 5!
- Fuel cost depends on the price of oil, and that has been on a wild ride...
- 65$ in early December, 90$ two months later (almost 40% more...)
  Price was negative in April 2020 (!?!)



- Fuel costs add a lot of uncertainty to Scoot's business!
  And that's why options exist.
- Today the price of one barrel of oil is 90$.
- Assume two things could happen by June 5:
  - Scenario 1 (probability 50%): oil price skyrockets to 150$.
  - Scenario 2 (probability 50%): oil price declines to 60$.
- Scoot calls DBS and asks:
  "I want an option that'll allow me to buy one barrel of oil at 90$ on June 5"
- What happens on June 5?
  - In scenario 1, Scoot saves 150-90=60$. Option is worth 60$.
  - In scenario 2, the contract is useless. Option is worth 0$.
- How much should DBS charge Scoot for the option?

- If you said 30$, you can still learn a lot from our QF modules!
- A “fair” fee that DBS should charge is 20$.
- But why?

Some Maths

- This is how it works:
- Today (1 barrel for 90\$), DBS takes 20\$ from Scoot and 40\$ from its safe, and buys $2/3$ barrels of oil.
- What does DBS do on June 5?
- In scenario 1 (1 barrel for 150\$),
  - DBS buys additional $1/3$ barrels of oil for 50\$,
  - gives 1 barrel of oil to Scoot for 90\$,
  - puts the net 40\$ (=90\$-50\$) back in the safe.
- In scenario 2 (1 barrel for 60\$),
  - DBS sells the $2/3$ barrels of oil it owns on the market for 40\$,
  - puts these 40\$ back in the safe.

- Regardless of what happens, DBS never loses money.
  It takes 40$ from its safe today and puts 40$ back in the safe on June 5.

- If DBS charges 21$ for the option, it will make 1$ in profits with no risk!

- For Scoot the option is an insurance:
  it won’t have to pay more than 90$ for a barrel of oil on June 5.

Speculation!

- Options are also used to speculate!
- You have 100\$ to invest.
- Maybe you know something that nobody else knows:
  you are sure that oil prices will go up to 150\$!
- You can
  - buy 100\$ of oil today (1.11 barrels), and sell them on June 5 for $1.11 \times 150\$ \approx 167\$$;
  - or buy 5 (call) options today, and they are going to be worth $5 \times 60\$ = 300\$$.
- But if you are wrong and oil prices go down to 60\$:
  - 1.11 barrels are worth 67\$, so you only lose 33\$;
  - 5 (call) options are worth nothing, so you lose everything!

- Trading options is very risky!
- If you sell options, there are no limits to how much you could lose!