M339W: March 11th, 2022.

Implied Volatility.

✓
- Assume that we can observe call/put prices in the market.
- Assume the Black-Scholes model

$\Rightarrow$ we have nice formulae for the call/put prices as functions of $(s, t, r, \delta, \sigma)$

Say that the value of an option @ a particular time t is:

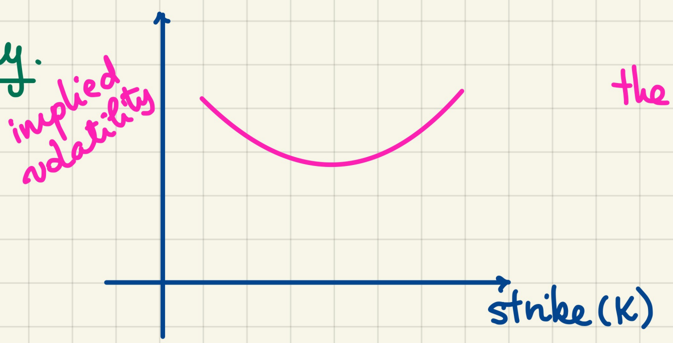
$$\boxed{v(\underbrace{s, t, r, \delta}_{\text{Assumed to be given / observed.}}, \sigma)}$$

Consider the Black-Scholes pricing formula as a function of σ.

We invert the Black-Scholes pricing formula to obtain the implied volatility σ.

Theoretically. If the above assumptions were true, the observed call prices for varying strikes K would all give us the same σ.

Practically.



the effect is called the

$\boxed{\text{VOLATILITY SMILE}}$