Options Pricing & Trading System

PRESENTED BY ARTEM ILIN

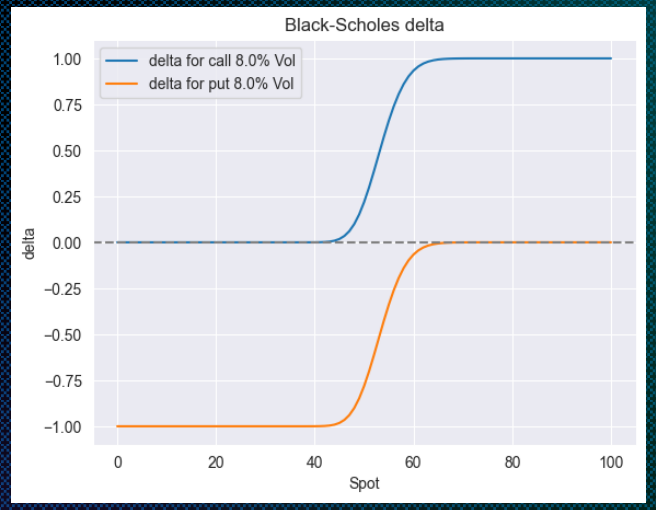
Yahoo Finance Data Parser

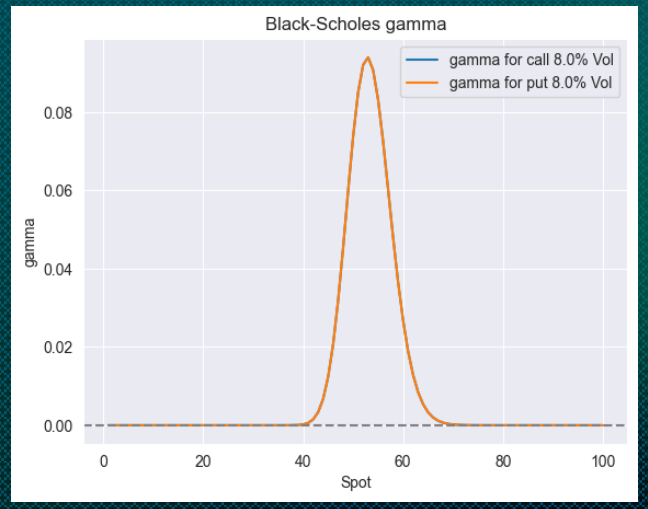
```
ticker = 'JPM'
```

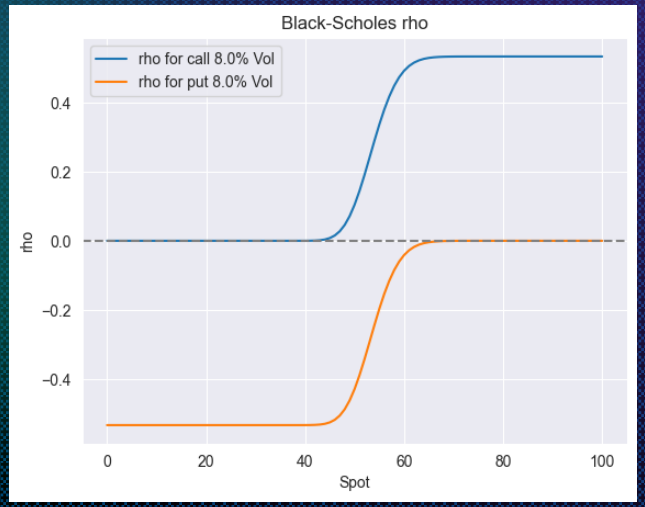
```
jpm_yf = yf_get_chains(ticker)
jpm_yf.head()
```

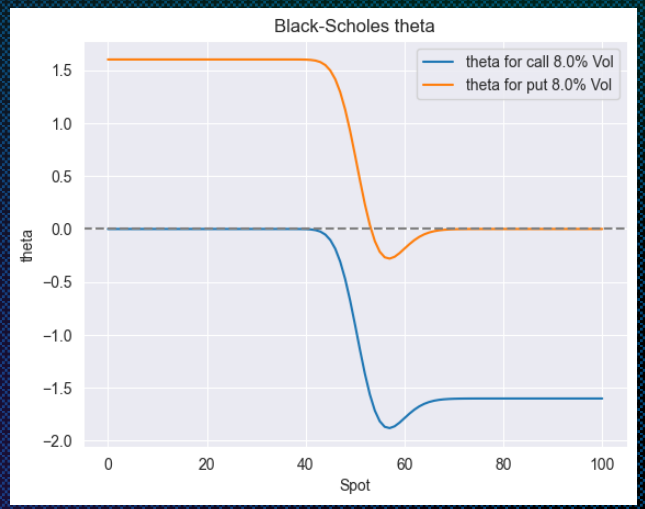
	contractSymbol	lastTradeDate	strike	lastPrice	bid	ask	change	percentChange	volume	openInterest	impliedVolatility	inTheMoney	contractSize	currency	optionType	expDate	daysToExp
0	JPM230203C00100000	2023-01-03 19:38:02+00:00	100.0	34.05	38.80	39.00	0.0	0.0	100.0	0	2.718753	True	REGULAR	USD	call	2023-02-03 23:59:59	1
1	JPM230203C00105000	2023-01-03 18:15:30+00:00	105.0	29.37	33.60	34.25	0.0	0.0	1.0	0	3.054690	True	REGULAR	USD	call	2023-02-03 23:59:59	1
2	JPM230203C00110000	2023-02-02 16:27:29+00:00	110.0	29.74	0.00	0.00	0.0	0.0	10.0	0	0.000010	True	REGULAR	USD	call	2023-02-03 23:59:59	1
3	JPM230203C00115000	2022-12-30 17:53:27+00:00	115.0	19.00	25.15	25.60	0.0	0.0	6.0	0	3.248049	True	REGULAR	USD	call	2023-02-03 23:59:59	1
4	JPM230203C00117000	2023-01-27 16:08:18+00:00	117.0	22.90	0.00	0.00	0.0	0.0	7.0	0	0.000010	True	REGULAR	USD	call	2023-02-03 23:59:59	1

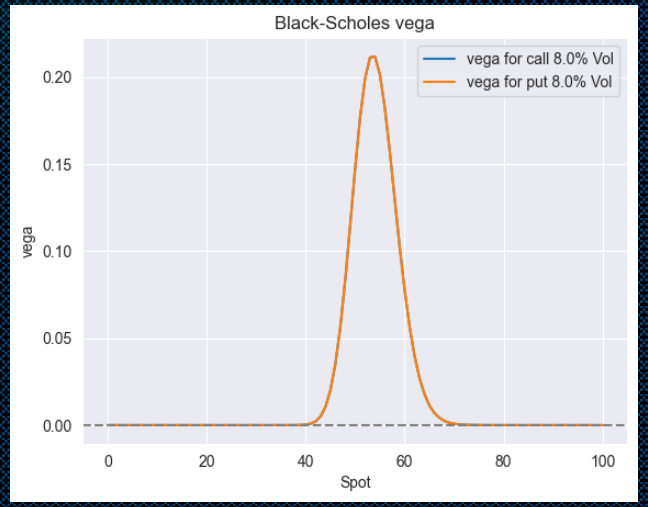
BSM & Greeks


Black-Scholes delta
delta for call 8.0% Vol
delta for put 8.0% Vol
delta
Spot


Black-Scholes gamma
gamma for call 8.0% Vol
gamma for put 8.0% Vol
gamma
Spot

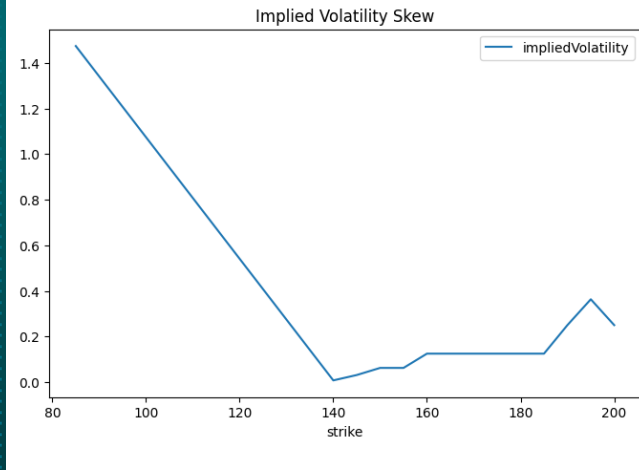

Black-Scholes rho
rho for call 8.0% Vol
rho for put 8.0% Vol
rho
Spot

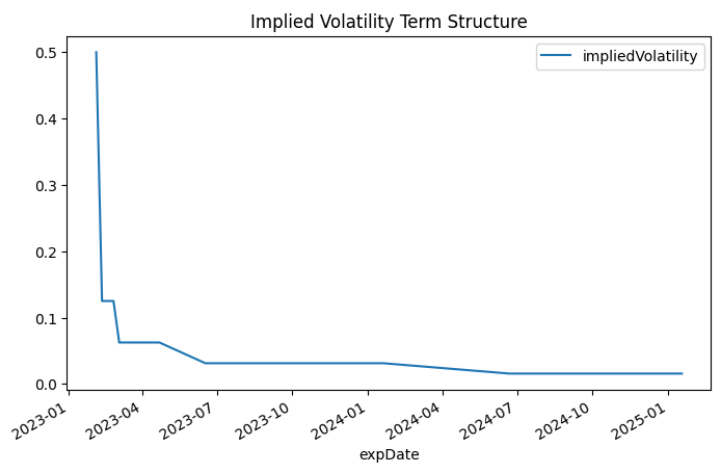

Black-Scholes theta
theta for call 8.0% Vol
theta for put 8.0% Vol
theta
Spot

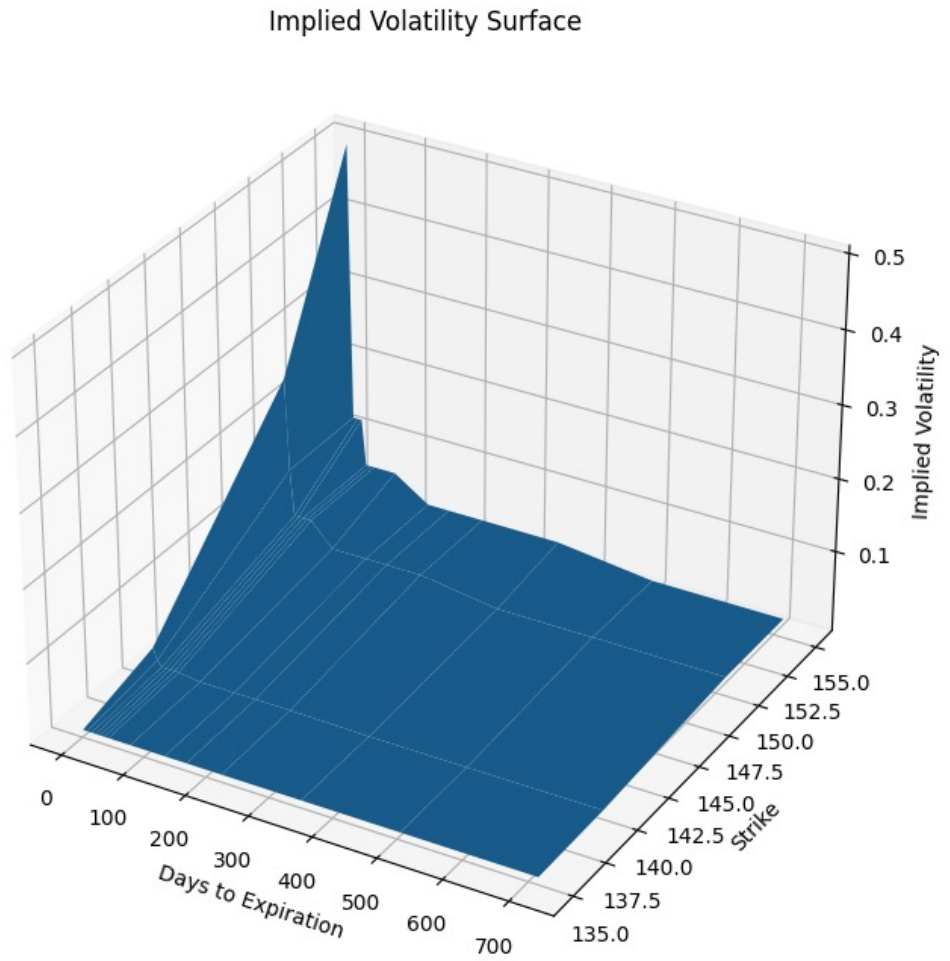

Black-Scholes vega
vega for call 8.0% Vol
vega for put 8.0% Vol
vega
Spot

Volatility

- Skew
- Term Structure
- Surface







Heston Model

$$dS_t = \mu S_t\,dt + \sqrt{v(t)}S_t\,dW_t^{(1)}$$

$$d\sqrt{v(t)} = -\beta\sqrt{v(t)}\,dt + \sigma\,dW_t^{(2)}$$

The correlation between the two Wiener processes is given by:

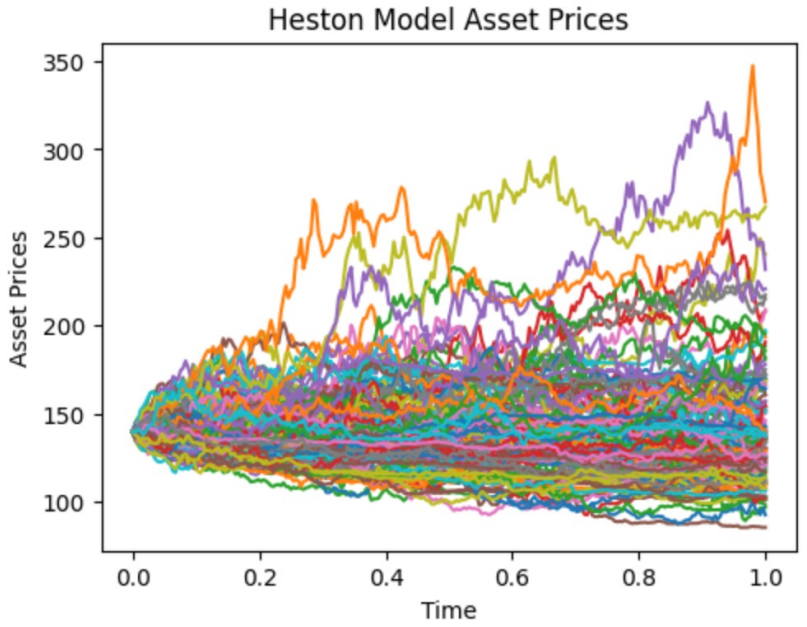
$$dW_t^{(1)}dW_t^{(2)} = \rho\,dt$$

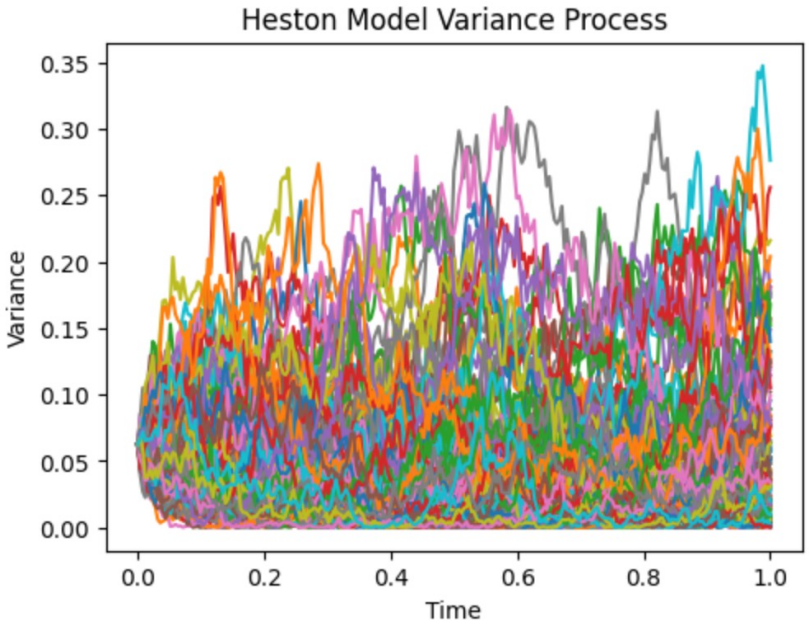
$S_t =$ spot price

$W_t^{(1)} =$ a Wiener process

$v(t) =$ variance

$\mu =$ (risk neutral) drift.





SABR Model

Different implied volatility shapes under Hagan's implied volatility parametrization, depending on different model parameters.

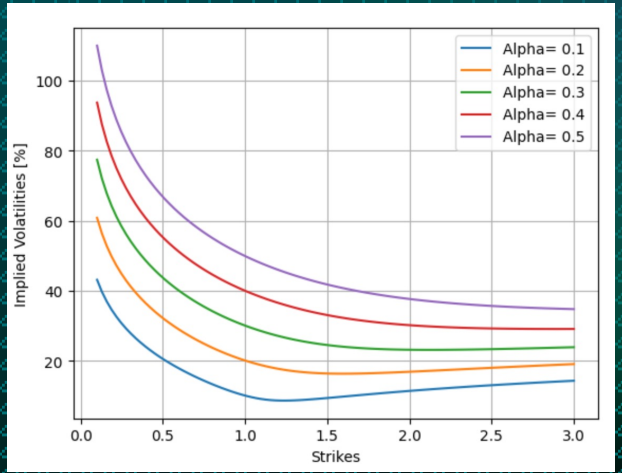
In figures given the effect of different model parameters on the implied volatility shapes is shown. Notice that both parameters β and ρ have an effect on the implied volatility skew. In practice, β is often fixed, whereas ρ is used in a calibration. Parameter α controls the level of the implied volatility smile and γ the magnitude of the curvature of the smile.

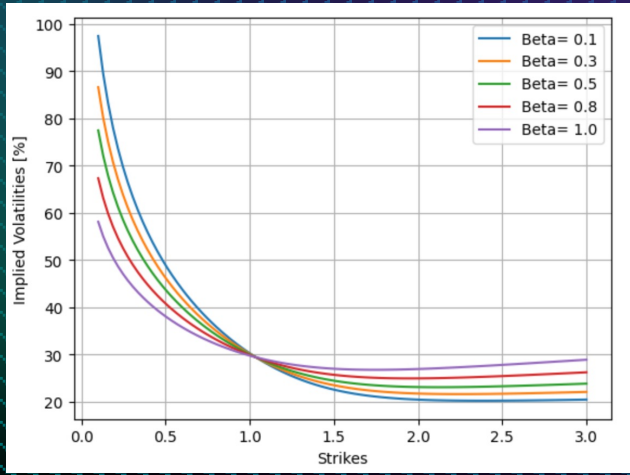
$$dF_t = \sigma_t (F_t)^{\beta}\, dW_t,$$

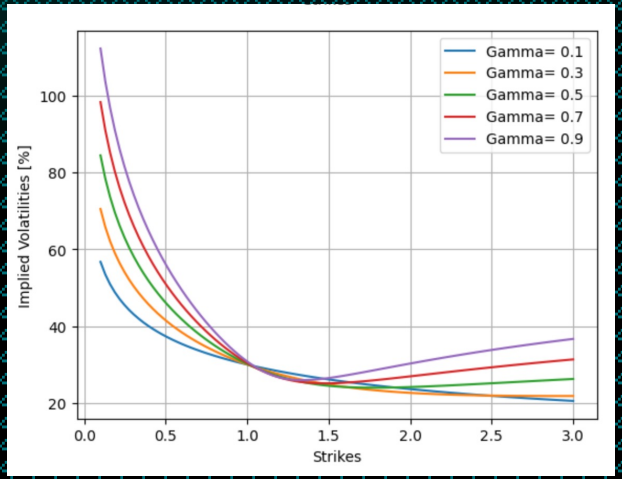
$$d\sigma_t = \alpha \sigma_t\, dZ_t,$$

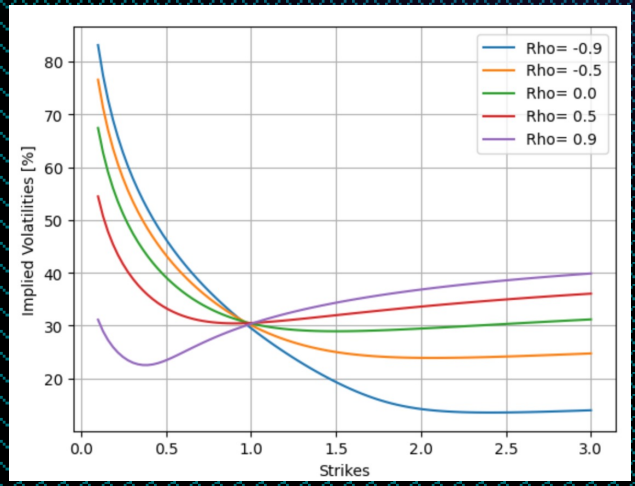
$$-1 < \rho < 1:$$

$$dW_t\, dZ_t = \rho\, dt$$









Future plans:

- Models calibrations
- MOEX Data Parser
- Bifurcation analysis
- Hedging