

Options Trading — Core Knowledge

Sources: Sheldon Natenberg, *Option Volatility and Pricing* (2nd Ed.) · *How to Calculate Options Prices and Their Greeks*
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Method: Cross-book semantic query via MCP AI Tutor (mcp-fin.db)
Collections: Option (Natenberg), How (Greeks book)

1. The Two Books — Complementary Perspectives

	Natenberg	How to Calculate Greeks
Style	Conceptual, broad	Computational, hands-on
Strength	Mental models, strategy intuition	Step-by-step BSM derivation, Monte Carlo hedging
Best for	Understanding <i>why</i>	Understanding <i>how to calculate</i>

Read as a pair, not as alternatives. Natenberg builds the worldview; the Greeks book fills in the numbers.

2. The 5 Core Patterns (Both Books Converge On)

Pattern 1 — Volatility Is the Real Asset, Not the Option

You are not trading calls and puts. You are trading **volatility**. The direction of the underlying is secondary. Both books spend more time on volatility than on any other topic — it is opened in Chapter 3 of the Greeks book before any pricing, and is the dominant theme throughout Natenberg.

Pattern 2 — The Gamma-Theta Tension Is the Engine of Everything

Every options position is ultimately a bet on this tradeoff:

	Long Gamma	Short Gamma
What you want	Large moves in the underlying	Underlying to stay still
What you collect	Gamma scalp profits	Daily theta (time decay)

	Long Gamma	Short Gamma
What you pay	Daily theta (decay)	Exposure to large moves

Long gamma = pay daily decay, profit convexly when the market moves.

Short gamma = collect daily decay, lose convexly when the market moves big.

Every strategy (straddles, strangles, spreads, ratio writes) is just a variation of this tradeoff.

Pattern 3 — Delta-Neutral Is the Baseline, Not the Strategy

Both books treat delta-hedging as table stakes — the prerequisite to isolate your volatility bet from directional noise. The Greeks book shows traders scalping delta at successive price levels (50→54→50→48) to monetize gamma. Natenberg covers ratio writes and covered calls purely as delta management tools.

The message: neutralize direction, then trade what remains.

Pattern 4 — BSM Is the Map, Not the Territory

Both books teach Black-Scholes thoroughly, then spend equal time on its failure modes. The central violated assumption: **volatility is not constant**. Natenberg dedicates a full chapter — "*Models and the Real World*" — to listing every BSM assumption and where it breaks. The Greeks book introduces skew in Ch. 11 as empirical proof that BSM is wrong.

BSM is a necessary scaffold — not a truth. Use it to price, then adjust for what it cannot see.

Pattern 5 — The Vol Surface Is Where the Real Edge Lives

Once you know BSM and the Greeks, your edge comes from reading the volatility surface better than the next trader. Both books converge here as their most advanced topic:

- **Skew** — implied vol varies by strike (lower strikes carry higher IV in equity/crypto markets — the leverage effect)
- **Term structure** — implied vol varies by expiration (short-dated IV reacts faster to fear than long-dated)
- **Smile** — U-shaped IV curve across strikes in some markets

Natenberg: sticky-strike vs sticky-delta skew. Greeks book: smile shapes across maturities and kurtosis regimes.

3. Implied Volatility — The Market's Forward-Looking Signal

Definition

BSM has 5 inputs: price, strike, time, interest rate, volatility. All observable except **future volatility**. Implied volatility (IV) inverts this — take the current market option price and solve backwards for the volatility that would produce it.

IV = the market's consensus forecast of future realized volatility

Realized vs Implied — The Vol Risk Premium

	Realized Volatility (RV)	Implied Volatility (IV)
Definition	Annualized std dev of past price changes	Extracted from current option prices
Direction	Backward-looking	Forward-looking
Association	The underlying contract	Options on the contract

The key empirical fact: IV almost always runs *above* RV. This gap is the **volatility risk premium** — the market systematically overpays for insurance.

Natenberg documents this directly with S&P 500 12-month IV vs. future RV over a decade. The premium is persistent.

The IV-RV Spread as a Signal

$$\text{vol_premium} = \text{IV}_{30d} - \text{RV}_{30d}$$

Spread	Market State	Regime Signal
Large positive (IV >> RV)	Market is fearful, pricing in future chaos	Bear regime — crisis incoming or ongoing
Near zero (IV ≈ RV)	Market is calibrated, equilibrium	Bull or Choppy — normal conditions
Negative (RV > IV)	Market is complacent, moves outpace expectations	Regime shift risk — precedes sharp moves

The Leverage Effect

When the underlying drops, at-the-money implied vol rises — falling prices compress equity, increasing financial risk, so vol spikes. This is why equity and crypto vol skew is almost always negatively sloped: lower strikes carry higher IV.

A sudden IV spike on a down move is a **regime transition signal**, not noise.

4. Short Volatility — Why You Cannot Just "Always Sell"

The Edge Is Real

The vol risk premium is documented and persistent. Selling options (straddles, iron condors, covered calls) generates steady theta income most of the time. Insurance companies are professional vol sellers. The carry is real.

The Failure Mode Is Catastrophic

The asymmetry is fatal if ignored:

- Short vol pays you in **linear, small increments** (daily theta)
- Short vol loses in **convex, large jumps** (gamma blowup)

Natenberg, on a short straddle after a gap move:

"The 100 calls that the trader sold will immediately go deeply into the money, acting like short underlying contracts. The straddle may have begun approximately delta neutral, but after the gap, the trader will find himself naked short deeply in-the-money calls."

Greeks book on gamma convexity:

"A move of \$4 in the Future will cost 16 times as much as just one dollar move. A trader who is short gamma will need to expect and anticipate them."

Loss scales with the **square** of the move. You collect nickels for months, then lose the account in a single session.

Historical examples: 1987 Black Monday, March 2020 (COVID), BTC -40% in a single day (May 2021).

The Kurtosis Framework

The Greeks book frames this as a **distribution problem**:

Market Type	Distribution	Gamma Position
Platykurtic (thin tails, low kurtosis)	Moves are small and frequent	Sell gamma — collect theta safely
Leptokurtic (fat tails, high kurtosis)	Rare but catastrophic moves	Buy gamma or go flat — never sell

Crypto markets are persistently leptokurtic. The fat tail is not rare — it is structural.

5. Connection to the HMM Regime Detector (Fortuna Stack)

The regime framework maps precisely onto the options vol framework:

HMM Regime	Vol Character	Distribution	Options Position
Bull (trending, low vol)	RV stable, IV slightly elevated	Platykurtic	Sell vol — collect theta
Choppy (sideways, mean-reverting)	RV low, IV compressed	Platykurtic	Sell vol — tightest edge
Bear (crisis, high vol)	RV spikes, IV spikes more	Leptokurtic	Buy vol or flat — never sell

Implied Vol as an Additional HMM Feature

Current observation vector: $(\text{fracChange}, \text{fracHigh}, \text{fracLow})$ — all realized, all backward-looking.

Adding **IV** (e.g., BTC DVOL from Deribit, or ATM option IV from any crypto options feed) gives the HMM a forward-looking feature for the first time.

The most useful derived feature:

vol_premium_t = IV_30d_t - RV_30d_t

- Large positive → market is pricing Bear — weight Bear posteriors higher
- Compressed → crowd is calm — Bull regime more likely
- Inverted (RV > IV) → complacency — regime shift incoming

The Core Insight

Most retail traders who blow up on short vol have no regime detector. They sell into Bear regime because the premium *looks juicy* right before the crash — IV is elevated, theta looks attractive, and then the gap move destroys them.

The $\gamma_k(i)$ posteriors from the HMM are already telling you when to sell and when to run. The Bear regime posterior spiking is precisely the signal to stop being a vol seller.

Your regime detector is the risk management layer that short vol strategies are missing.

6. Reading Hierarchy

1. Learn BSM (the foundation)
↓
2. Learn the Greeks – delta, gamma, theta, vega, rho
↓
3. Learn the skew / vol surface (where BSM breaks)
↓
4. Accept the model is wrong and trade the discrepancy
↓
5. Use regime detection to know which game you're playing

Both books teach steps 1–4. Your HMM + Fortuna stack is step 5.

7. Key Ideas — 2 From Each Book

From Natenberg — *Option Volatility and Pricing*

Idea 1 — Rehedging Frequency Is a Gamma Capture Policy

"By rehedging the position each week, we were able to capture a series of profits resulting from the mismatch between the option's changing delta and the fixed delta of the underlying contract."

The profit from a long gamma position doesn't sit passively — you have to **actively re hedge** to realize it. Each delta rebalance locks in a small gain from the price move. Rehedge too rarely: leave gamma profit on the table. Rehedge too often: transaction costs eat the edge.

Application: The RL agent's "trade / don't trade" decision is exactly a dynamic rehedge policy. Optimal rehedge frequency is regime-dependent — rehedge aggressively in high-gamma (Bear/volatile) regimes, infrequently in low-gamma (Choppy/calm) regimes. Gamma captured per unit of transaction cost paid is a natural reward structure for Fortuna.

Idea 2 — Volatility Contracts: Trade Vol Directly Without Options

"Traders have sought a less complicated method of implementing volatility strategies — this has led to the development of volatility contracts."

Natenberg dedicates a full chapter to instruments that let you take a position on volatility directly — without building and managing an options position. Realized variance contracts settle on actual RV vs. a strike vol. The VIX can double or triple in short periods.

Crypto equivalent: Deribit DVOL (BTC's VIX equivalent) and DVOL futures. When HMM γ_{Bear} spikes, go long DVOL futures — pure vol exposure, no greeks to manage. Cleaner signal-to-execution with the regime detector as the trigger.

From *How to Calculate Options Prices and Their Greeks*

Idea 1 — Kurtosis as an Explicit Position Selection Rule

"One would prefer being short gamma when being in a platykurtic environment and being long gamma when being in a leptokurtic environment."

The book identifies the **transition** between distribution regimes as the key event to trade around. Your position *type* should flip when the market's distribution character flips.

Kurtosis	Returns Shape	Position
Platykurtic (< 0)	Thin tails, bounded moves	Short gamma — collect theta
Mesokurtic (≈ 0)	Normal	Neutral
Leptokurtic (> 0)	Fat tails, rare catastrophic moves	Long gamma — buy convexity

Crypto is **persistently leptokurtic** — the default position should be long gamma. Only flip short gamma in explicitly identified platykurtic windows. The HMM Choppy regime is the platykurtic window signal. Bull and Bear are both leptokurtic — stay long gamma in both.

Idea 2 — Vomma: Convexity on Your Convexity

"The change in vega for options is being called vomma. The vega of out-of-the-money options is changing when volatility changes."

When vol spikes from 20% → 30%, ATM options barely change their vega — but OTM puts increased their vega by **66%**. That acceleration is vomma — the second derivative of option price with respect to vol.

This creates a double-convexity payoff when buying OTM options before a regime shift: 1. Vol rises → vega profit (first order) 2. Vega itself grows as vol rises → additional vomma profit (second order)

Application: When γ_{Bear} starts climbing, OTM puts are the highest-leverage instrument — not because of delta, not just vega, but because vomma compounds as the regime shift deepens. The HMM is the timing signal; vomma tells you *which* option to buy once you've timed it.