

Volatility-Based Sizing (Formula 14) X-Factor Volatility Stops

$$\text{Notional Exposure} = \frac{R_t \cdot C}{\sigma_i} \quad \text{where} \quad R_t = \text{Target Annual Risk} \quad x = \frac{|\Delta P|}{\sigma} \quad \text{Stop} = P \cdot (1 - x \cdot \sigma)$$

Units (Unleveraged):

$$\text{Units} = \frac{\text{Notional Exposure}}{P} \quad \text{or} \quad \frac{R_t \cdot C}{\sigma \cdot P}$$

Used in all Carver models to translate risk into position sizing across markets.

Use: Volatility-adjusted risk management that reacts to recent price moves.

[Insert TikZ chart: X-Factor vs Stop Width]

Capital & Leverage Calculations

$$\text{Leverage Factor (LF)} = \frac{\text{Notional}}{C} \quad \text{Leverage Ratio} = \text{LF}-1$$

$$C_t = C_0 + \sum_{i=1}^t \Delta P_i \cdot u_i \quad (\text{PnL-adjusted capital})$$

Forecasts are scaled to updated capital each time step.

Price Unit Volatility (PUV)

$$\text{PUV} = \sigma \cdot P \quad \Rightarrow \quad \text{Units} = \frac{\text{Notional}}{\text{PUV}}$$

High $\sigma \Rightarrow$ high PUV \Rightarrow fewer contracts. Low $\sigma \Rightarrow$ lower PUV \Rightarrow more size.

From: Leveraged Trading, Ch. 4–5

Forecast Modulation

$$E_i = \frac{f_i}{20} \cdot \frac{R_t \cdot C}{\sigma_i} \quad \text{with} \quad f_i \in [-20, +20]$$

Forecast Scaling: Each forecast type is capped to avoid overfitting:

$$f_{\text{scaled}} = \max(\min(f, 20), -20)$$

Used in: Systematic Trading, Ch. 10

Drawdown Regime Logic

$$\text{Drawdown}_t = 1 - \frac{C_t}{\max(C_{1..t})} \quad (\text{Peak-to-trough decline})$$

Trigger: If DD > 20%, reduce R_t , or risk OFF.

Regime Tree:

- Normal \rightarrow Risk ON
- DD > threshold \rightarrow Halve position
- Max DD \rightarrow Full cash

[Insert TikZ tree: Regime transitions]

Portfolio Volatility Targeting

$$\sigma_p^2 = \sum w_i^2 \sigma_i^2 + \sum_{i \neq j} w_i w_j \rho_{ij} \sigma_i \sigma_j$$

Constraint: $\sigma_p \approx R_t$

Related to: Smart Portfolios (Carver) — covariance-based diversification.

Forecast Models (Carver)

- **Trend:** EWMAC, Donchian breakout
- **Carry:** Roll yield, interest differential
- **Reversion:** Swing indicators, mean pullback
- **Momentum:** Multi-frame strength
- **Skew:** Return asymmetry
- **Acceleration:** Δ forecast change

Aggregate Forecast:

$$f = \sum w_k f_k \quad \text{where} \quad \sum w_k = 1$$

Forecast Invariance

- Volatility-normalized forecast execution
- All models constrained to same risk unit
- Forecast clipping prevents overleverage

Core to Carver's robustness principles.

Backtesting Checklist (Systematic)

- Include transaction costs and slippage
- Model fill latency or execution lag
- Parameter decay and overfitting tests
- Evaluate Sharpe degradation over time

Best practices from Ch. 11, Systematic Trading

System Modules (Modular Architecture)

- **Signal Engine** → Forecasts
- **Volatility Engine** → Annualized σ
- **Capital Engine** → Realized C_t
- **Risk Engine** → Sizing
- **Execution Filter** → Throttle trades

[Diagram: Modular Trading Stack]