Risk Methodology

Stress testing framework used in PrimeRisk portfolio risk reports.

Equity Stress Scenarios

Three independent stress scenarios are computed for every equity (non-SPAC) position.

SCENARIO	NAME	FORMULA	DESCRIPTION
S1	200 DMA	`MV × (MA200 − Price) / Price`	P&L if the stock price reverts to its 200-day moving average. Longs lose when trading above MA; shorts gain.
S2	Cap %	`-	MV
S3	1Sd Vol	`MV × (-√(10/252) × IV)`	10-day 1-sigma vol shock. Uses implied volatility (IV) when available, otherwise beta × 18% market vol proxy.
3Sd	3Sd Vol	`3 × S3`	Extreme tail stress — three standard deviations of the 10-day vol move.
Extreme	Worst-case	`min(S1, S2, 3Sd)`	The single worst outcome across all equity scenarios for each position.

Directional SD Columns

For equity positions the report also shows signed SD moves (using signed MV):

- **-3 SD / -2 SD / -1 SD**: P&L if the underlying drops by N sigma (positive for shorts)
- **+1 SD / +2 SD / +3 SD**: P&L if the underlying rises by N sigma (negative for shorts)
- **-25% / +25%**: P&L for a flat 25% price move in each direction

Market-Cap Stress Grid

The Cap % scenario uses a tiered minimum return based on market capitalization. Smaller companies face steeper adverse stress returns.

The default grid is calibrated from the empirical CVaR 99.9% of 3-day returns, based on a study of 5.37 million observations across 2,509 US equities over 21 years. See the full Cap Stress Paper for methodology and robustness analysis.

BUCKET	MARKET CAP RANGE	LONG STRESS (CVAR 99.9%)
1	< $280M	-50%
2	$280M – $630M	-44%
3	$630M – $1B	-40%
4	$1B – $2B	-37%
5	$2B – $4B	-34%
6	$4B – $8B	-32%
7	$8B – $23B	-30%
8	≥ $23B	-27%

In the portfolio builder, the **Cap Stress Grid** panel provides:

- **Editable boundaries** — adjust the market cap breakpoints between buckets
- **Long Stress %** — the base stress applied to long positions (pre-filled from empirical CVaR 99.9%)
- **Custom %** — an override column; enter a multiplier at the top (e.g. 150) to scale the base stress, then adjust individual buckets
- **Short Stress %** — separate stress for short positions (blank by default; when filled, applies to short positions instead of Long %)

Industry Overrides

Certain industries (e.g. Biotechnology) may exhibit significantly different tail risk than the broad market. The **Industry Overrides** panel lets you define separate stress grids for specific industries. When a position's industry matches an override, the industry-specific grid is used instead of the default.

Each industry override includes:

- **Industry selector** — choose from common industries or type a custom name
- **Full stress grid** — independent cap boundaries, long %, custom %, and short % columns
- Multiple overrides can be active simultaneously for different industry groups

SPAC Stress Scenario (S4)

SPAC positions are stressed to **95% of the $10 trust floor** (stress price = $9.50).

The CIT (cash-in-trust) per share is resolved using a four-level hierarchy:

1. **External source** — user-supplied trust per share
2. **SEC filing** — parsed from 10-Q/10-K filings via EDGAR
3. **Accrued trust** — trust per share + accrued T-bill interest from issuance date
4. **Default** — $10.00 par value

The stress P&L = `Quantity × (StressPrice − CurrentPrice)`.

Option Stress Scenarios

Options are repriced using the Black-Scholes model under three categories of stress.

S5 — Underlying Price Stress (Vol Flat)

The underlying price is shocked by N standard deviations while implied volatility remains unchanged.

SCENARIO	UNDERLYING MOVE	VOL CHANGE
-3 SD	Price × (1 − 3σ√(10/252))	Flat
-2 SD	Price × (1 − 2σ√(10/252))	Flat
-1 SD	Price × (1 − 1σ√(10/252))	Flat
+1 SD	Price × (1 + 1σ√(10/252))	Flat
+2 SD	Price × (1 + 2σ√(10/252))	Flat
+3 SD	Price × (1 + 3σ√(10/252))	Flat

S6 — Implied Volatility Shock (Price Flat)

The underlying price is held constant while implied volatility is shifted.

SCENARIO	PRICE CHANGE	VOL CHANGE
Vol -25%	Flat	IV × 0.75
Vol +25%	Flat	IV × 1.25
Vol +50%	Flat	IV × 1.50

Term-Structure Adjustment

All vol shocks (S6 and the vol component of S7) are **term-adjusted** to reflect the fact that short-dated options are more sensitive to vol changes than longer-dated ones:

```
effective shock = base shock × √(30 / max(DTE, 5))
```

- **30-day options** are the anchor point — they receive the base shock unscaled (√(30/30) = 1.0).
- **Shorter-dated options** (e.g. 7 DTE) see an amplified shock (√(30/7) ≈ 2.07×).
- **Longer-dated options** (e.g. 90 DTE) see a dampened shock (√(30/90) ≈ 0.58×).
- A floor of 5 DTE prevents the multiplier from blowing up near expiration.

For example, a Vol +25% shock on a 10-day-to-expiration option produces an effective vol shift of `+25% × √(30/10) = +43.3%`.

S7 — Combined Scenarios

Simultaneous price and volatility moves simulate realistic market regimes. The vol component of each scenario is term-adjusted as described above.

SCENARIO	UNDERLYING MOVE	VOL CHANGE (BASE)	MARKET REGIME
Crash	-2 SD	Vol × 1.25 (+25%)	Severe sell-off with volatility spike
Correction	-1 SD	Vol × 1.15 (+15%)	Moderate pullback with modest vol increase
Rally	+2 SD	Vol × 0.80 (-20%)	Strong rally with vol compression
Vol Spike	Flat	Vol × 1.50 (+50%)	No price move but extreme vol expansion

Black-Scholes Pricing Model

All option repricing uses the **Black-Scholes European option pricing model**.

For a call option:

$$C = S \cdot N(d_1) - K \cdot e^{(-rT)} \cdot N(d_2)$$

For a put option:

$$P = K \cdot e^{(-rT)} \cdot N(-d_2) - S \cdot N(-d_1)$$

Where:

- S = current underlying price
- K = strike price
- T = time to expiration in years (DTE / 365)
- r = risk-free rate (current T-bill rate)
- σ = implied volatility (annual, decimal)
- $N(\cdot)$ = standard normal CDF
- $d_1 = [\ln(S/K) + (r + \sigma^2/2)T] / (\sigma\sqrt{T})$
- $d_2 = d_1 - \sigma\sqrt{T}$

Greeks Definitions

GREEK	SYMBOL	DEFINITION	INTERPRETATION
Delta	Δ	$\partial C/\partial S$	Rate of change of option price per $1 move in the underlying. Calls: 0 to +1; Puts: -1 to 0.
Gamma	Γ	$\partial^2 C/\partial S^2$	Rate of change of delta per $1 move in the underlying. Higher near ATM and near expiry.
Theta	Θ	$\partial C/\partial t$	Daily time decay — how much the option loses per calendar day, all else equal. Always negative for long options.
Vega	ν	$\partial C/\partial \sigma$	Option price change per 1 percentage point change in implied volatility. Always positive for long options.

Position-Level Greeks

In the By Issuer tab, Greeks are aggregated at the position level:

- **Net Delta** = Σ (delta × quantity × 100) — expressed as equivalent shares
- **Net Gamma** = Σ (gamma × quantity × 100)
- **Net Vega** = Σ (vega × quantity × 100)

By Issuer Aggregation

The By Issuer view shows total risk per underlying, combining stock positions and all option positions on the same ticker.

- **Stock MV** — market value of the equity position
- **Opt MV** — total market value of all option positions on this underlying
- **Total MV** — Stock MV + Opt MV
- **Combined SD columns** — stock directional SD P&L + option S5 price-stress P&L at the matching SD level
- **Opt Crash / Corr / Rally / VolSpk** — sum of S7 combined-scenario P&L across all options

Portfolio Risk Metrics

METRIC	FORMULA	DESCRIPTION
Single Issuer Risk	`min(Extreme)` across all positions	Worst single-name loss
5-Issuer Risk	`Σ(5 worst Extremes) × 0.70`	Concentrated risk with 30% diversification discount
Sector Risk	`2 × (worst sector 1Sd)`	2-sigma sector-level stress
3-Sector Stress	`Σ(3 worst sector 1Sd) × 2 × 0.70`	Multi-sector stress with discount
5 SPAC Risk	`Σ(5 worst SPAC P&Ls) × 0.70`	Concentrated SPAC stress

Other Prime Stress Methodologies

PrimeRisk's equity stress framework is modeled after the **A Prime Stress** proprietary 4-scenario approach. For comparison, here are the two most widely used retail/institutional prime broker margin methodologies:

Interactive Brokers (IBKR)

IBKR uses OCC TIMS as a base with proprietary house add-ons including global concentration charges, singleton margin, small-cap adjustments, per-contract minimums, and days-to-liquidate surcharges.

- IBKR Portfolio Margin; overview of IBKR's risk-based margin system
- IBKR Margin Requirements; published maintenance margin tables

Charles Schwab / TD Ameritrade

Schwab/TDA uses OCC TIMS as a base with a Risk-Based Concentration (RBC) model that adds margin when the volatility-implied price range exceeds the standard scan range, plus Point of No Return (PNR) monitoring and a 30% absolute minimum maintenance floor.

- Schwab Portfolio Margin; eligibility and overview
- Schwab Margin Requirements; published margin rates and maintenance requirements
- thinkorswim Margin Handbook (PDF); detailed margin methodology inherited from TD Ameritrade