

# FIN02: Technical Analysis

Volatility Methodology & Detailed Findings | January 31, 2026

## 1. Data Overview

Analysis Period	2016-02-03 to 2026-01-30
Total Data Points	27,643
Securities Analyzed	11
Primary Data Source	Yahoo Finance (Daily OHLCV)

## 2. Volatility Estimation Methodologies

### 2.1 Close-to-Close (Historical) Volatility

Standard deviation of log returns, annualized:

$$\sigma = \sqrt{(\sum(r_t - \mu)^2 / (n-1))} \times \sqrt{252}$$

### 2.2 Parkinson Volatility

Uses high-low range, more efficient with ~5x information content:

$$\sigma_P = \sqrt{(1/(4\ln(2)) \times E[\ln(H/L)^2])} \times \sqrt{252}$$

### 2.3 Garman-Klass Volatility

Incorporates OHLC data for improved efficiency:

$$\sigma_{GK} = \sqrt{(0.5 \times \ln(H/L)^2 - (2\ln(2)-1) \times \ln(C/O)^2)} \times \sqrt{252}$$

## 2.4 Yang-Zhang Volatility

Accounts for overnight jumps and opening gaps:

$$\sigma_{YZ} = \sqrt{(\sigma_{\text{overnight}}^2 + k \times \sigma_{\text{open}}^2 + (1-k) \times \sigma_{\text{RS}}^2)} \times \sqrt{252}$$

## 3. Volatility Statistics by Bank

Ticker	Mean HV21	Std HV21	Min HV21	Max HV21	Parkinson	Vol-of-Vol
<b>GS</b>	26.44%	13.19%	9.89%	134.90%	22.10%	3.77%
<b>MS</b>	28.04%	14.55%	8.83%	152.93%	23.28%	4.09%
<b>JPM</b>	23.69%	14.10%	6.92%	134.70%	19.51%	3.60%
<b>C</b>	28.37%	17.16%	9.13%	161.88%	23.56%	4.11%
<b>BAC</b>	27.34%	14.55%	9.51%	142.94%	22.52%	4.03%

## 4. Correlation Analysis

Rolling correlations computed across multiple windows (21, 63, 126, 252 days).

### 4.1 VIX Correlation (63-day rolling average)

Ticker	Avg Correlation	Interpretation

## 5. Tail Risk Decomposition

Metric	Mean	Std Dev	Risk Implication
Daily VaR 95%	-2.71%	0.16%	Expected loss exceeded 5% of days
CVaR 95%	-0.043	0.003	Average loss when VaR breached
Return Skewness	0.226	0.175	Negative = left tail heavier
Return Kurtosis	11.911	1.643	Higher = fatter tails

Maximum Drawdown	-49.83%	4.67%	Worst peak-to-trough decline
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## 6. Volatility Surface Proxy

Synthetic implied volatility surface generated using historical volatility as base, with adjustments for moneyness (smile/skew) and term structure.

**Key Observation:** Investment bank options typically exhibit pronounced put skew, reflecting market concerns about tail risk. The skew steepens during periods of elevated VIX.

## 7. Data Quality Notes

- Adjusted close prices used for return calculations (dividend/split adjusted)
- Missing data points forward-filled (holidays, gaps)
- Outliers > 5 standard deviations flagged but not removed
- Correlation calculations require minimum 90% data overlap

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