Drawdowns

Measuring peak-to-trough declines

Christos Galerakis

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1 Abstract

A drawdown measures the decline from a historical peak to a subsequent trough. Maximum drawdown (MDD) represents the largest peak-to-trough decline over a period and is a key risk metric that captures the worst-case loss an investor could have experienced.

2 Definition

The drawdown at time t is:

$$DD_t = \frac{P_t - P_{max,t}}{P_{max,t}}$$

Where:

- P_t = current price
- $P_{max,t} = \max_{s \leq t} P_s$ = running maximum price up to time t

The **maximum drawdown** is:

$$MDD = \min_t(DD_t)$$

Note: Drawdowns are typically expressed as negative percentages.

3 Recovery Time

The **drawdown duration** is the time from peak to recovery (new high). Extended drawdowns can be psychologically challenging and may force liquidation at the worst time.

4 Compute (Python)

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Maximum Drawdown: -33.72%
Peak Date: 2020-02-19
Trough Date: 2020-03-23
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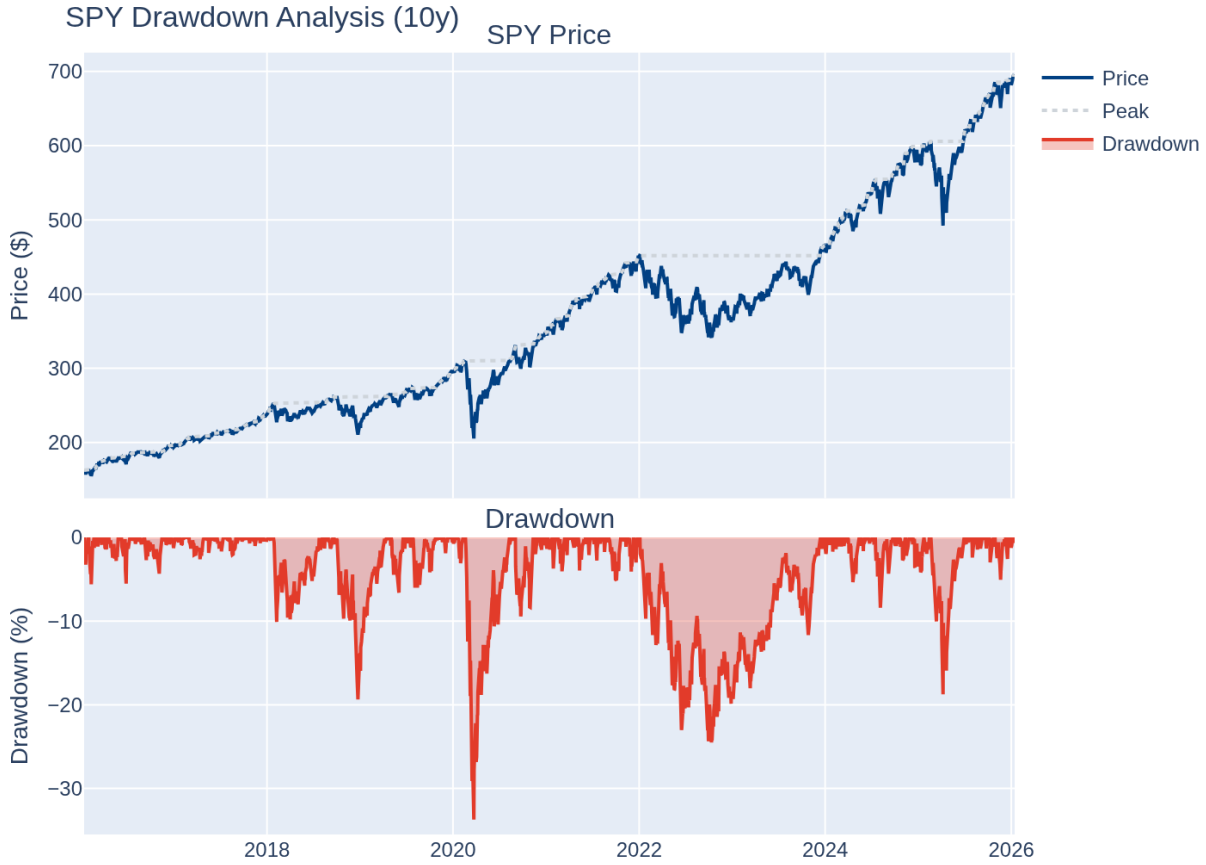
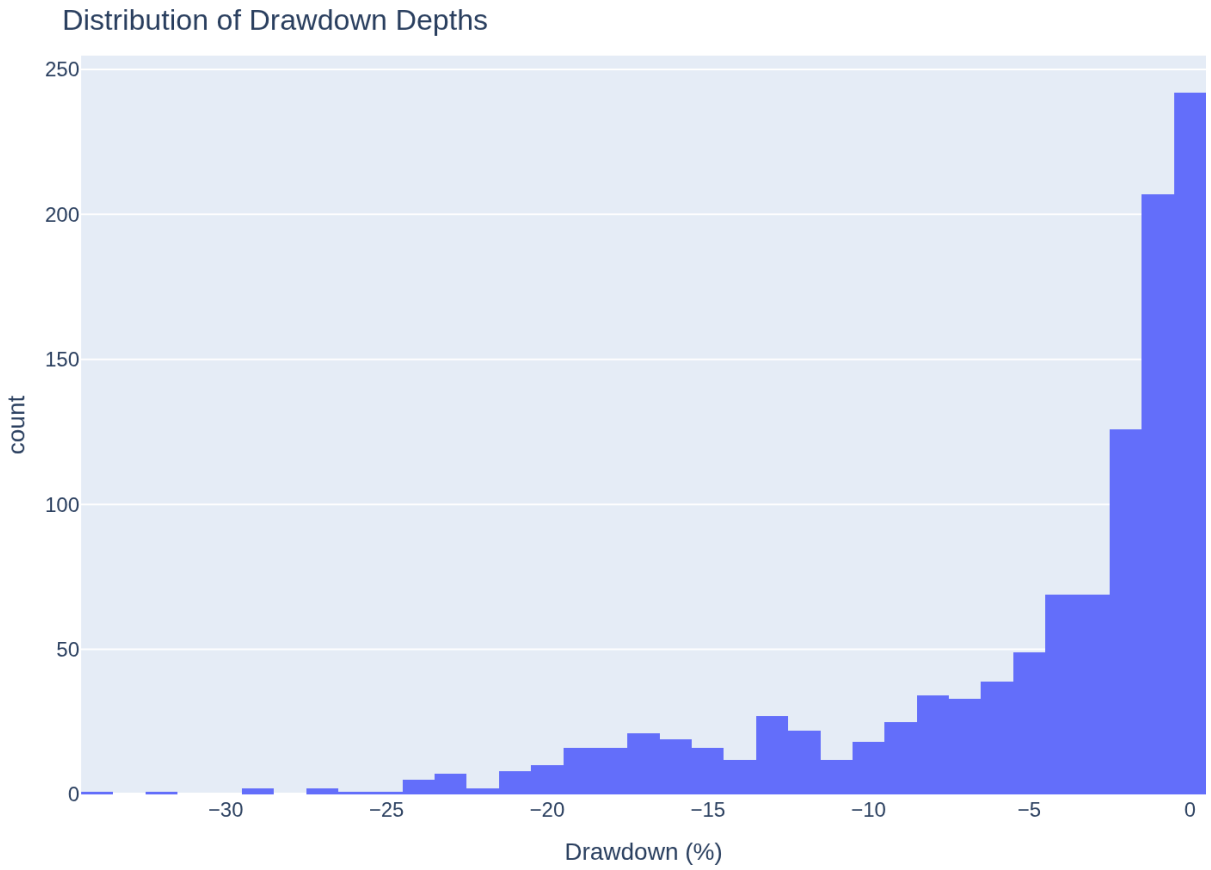
5 Price and Drawdown Chart



6 Worst Drawdowns

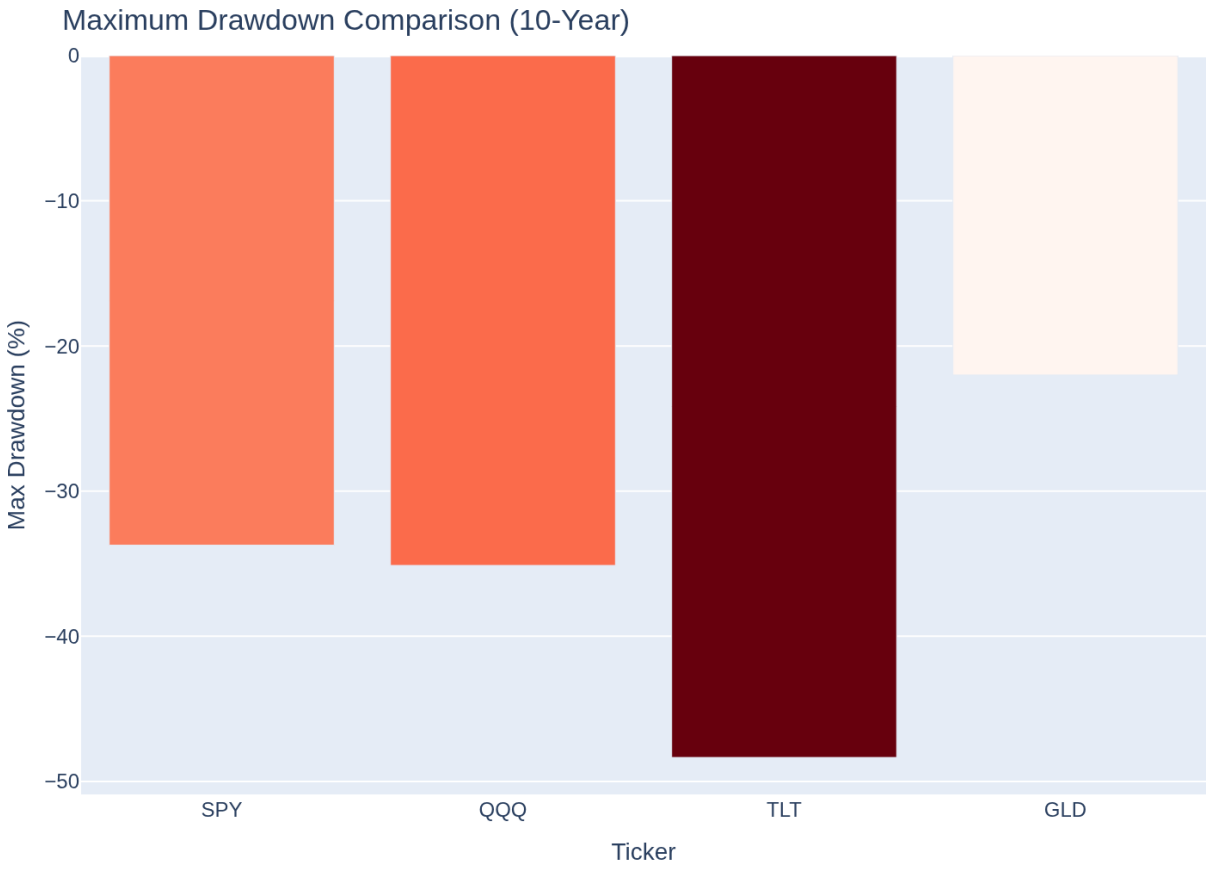
	Peak Date	Trough Date	Recovery Date	Drawdown (%)	Days to Trough	Days to Recovery
95	2020-02-20	2020-03-23	2020-08-10	-33.72	32	172.0
145	2022-01-04	2022-10-12	2023-12-13	-24.50	281	708.0
70	2018-09-21	2018-12-24	2019-04-12	-19.35	94	203.0
178	2025-02-20	2025-04-08	2025-06-26	-18.76	47	126.0
66	2018-01-29	2018-02-08	2018-08-06	-10.10	10	189.0

7 Drawdown Distribution



8 Comparison Across Assets

	Ticker	Max Drawdown (%)	Avg Drawdown (%)	Time in Drawdown (%)
0	SPY	-33.72	-5.09	83.82
1	QQQ	-35.12	-7.22	84.53
2	TLT	-48.35	-20.80	98.09
3	GLD	-22.00	-7.25	92.80



9 Conclusion

Drawdown analysis reveals the risk that volatility measures miss: the actual peak-to-trough losses an investor experiences. Maximum drawdown is essential for setting realistic expectations, sizing positions appropriately, and comparing strategies on a risk-adjusted basis. A strategy with higher returns but deeper drawdowns may be unsuitable for investors who cannot tolerate large interim losses.