



Long/Short Extensions: How Much Shorting is Enough?

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Portfolio Constraints and the Theory of Short Extension Strategies

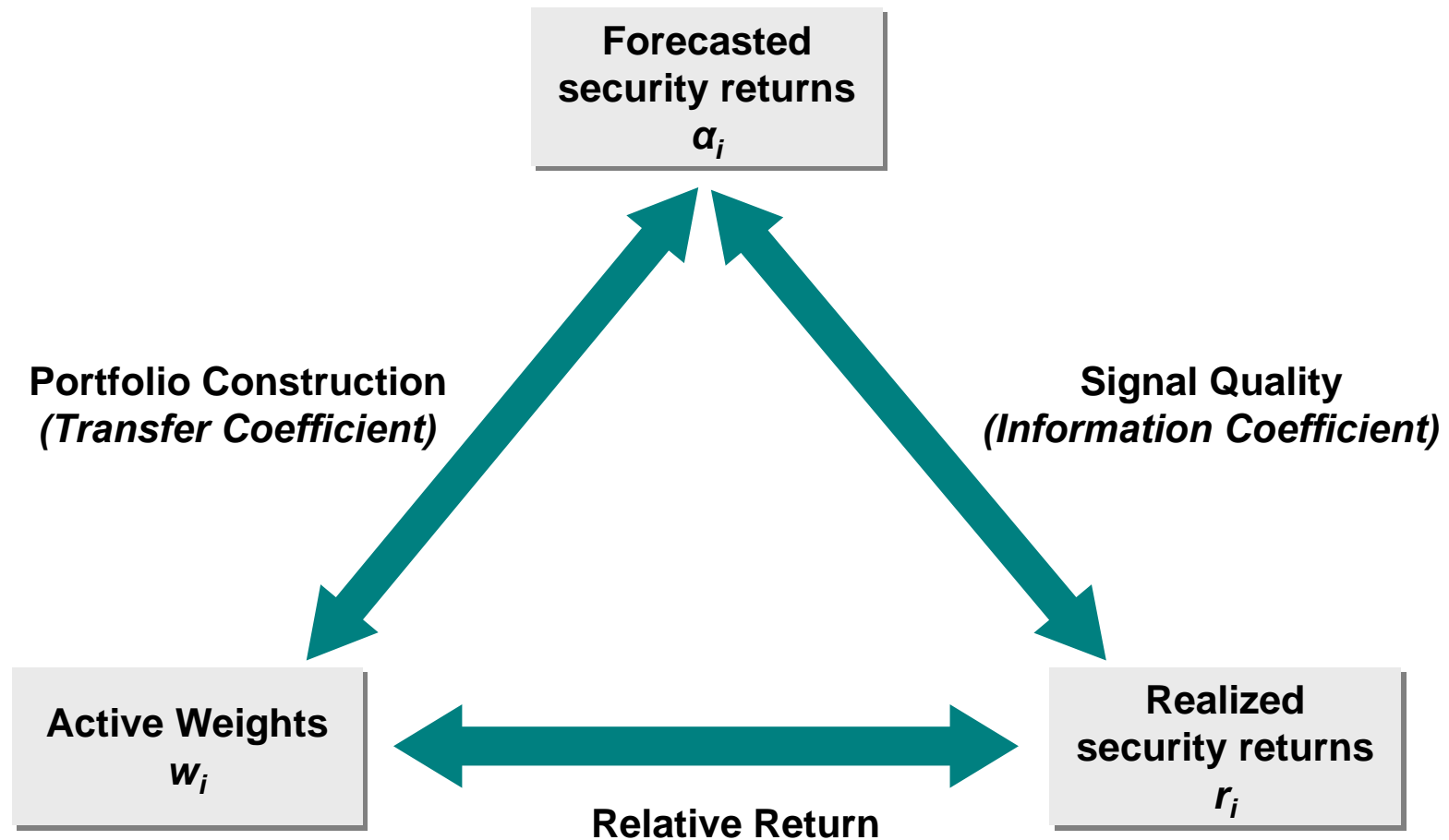
Theory of active management



In practice, when a numerical optimizer is employed to find optimal active security weights there are always constraints. Examples:

- Long-only constraint
- Turnover constraint
- Factor neutrality constraints
- Social choice constraints
- Bounds on individual security weights

Reality of active management: Performance Triangle



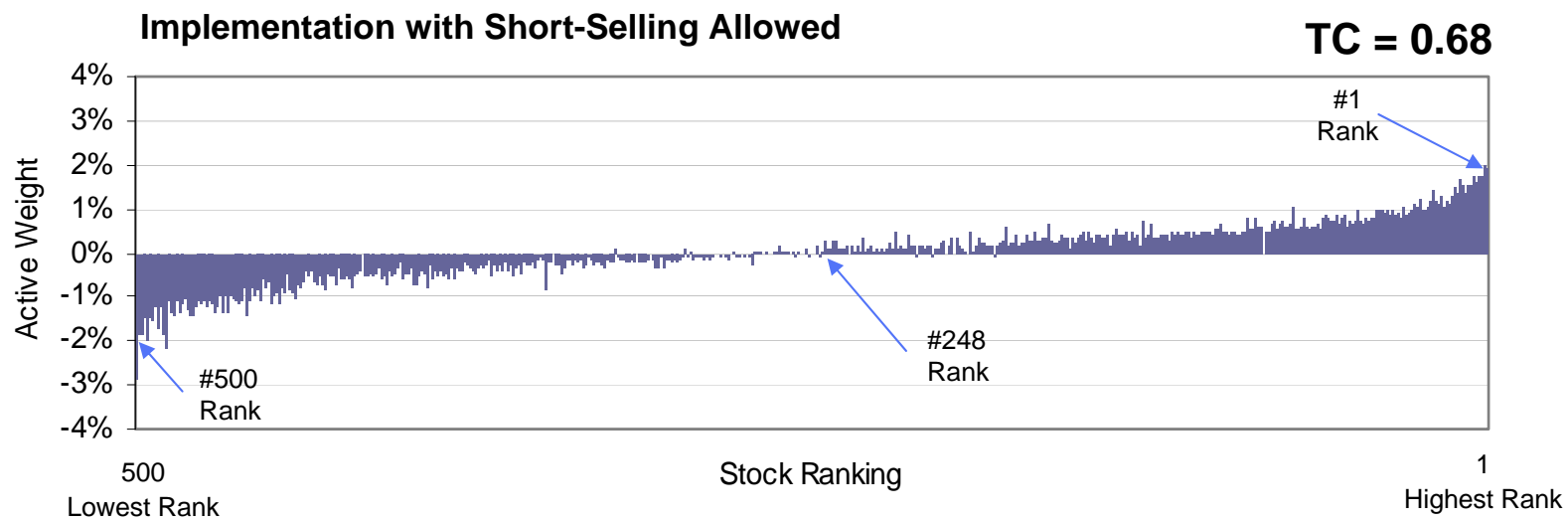
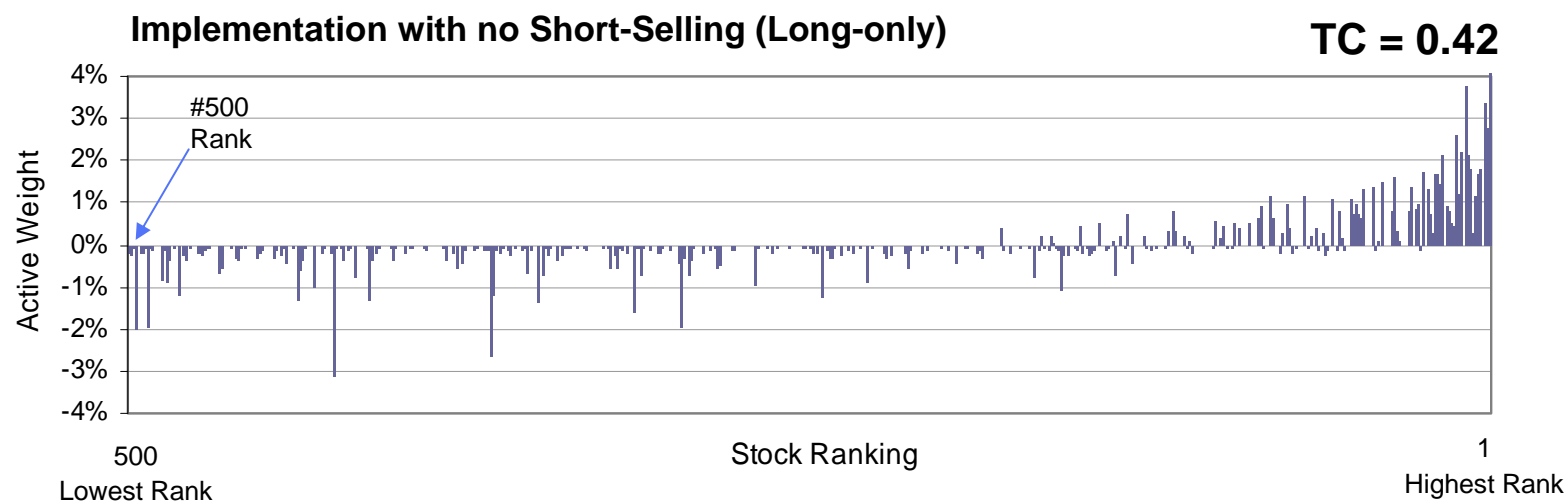
The value added by active portfolio management is a function of:

- Signal quality as measured by the Information Coefficient
- Portfolio construction as measured by the Transfer Coefficient

The Transfer Coefficient

- TC is a measure of how effectively the investor's information is transferred into the portfolio structure
- TC is measured as the correlation between the attractiveness of the security and its relative weight in the portfolio (adjusted for risk)
- Portfolios with more binding constraints tend to have lower transfer coefficients and lower expected information ratios
- The long-only constraint tends to be one of the more binding constraints and relaxing it even a little can improve the portfolio's information ratio considerably

Active Weights With and Without Shorting



Fundamental law equation

An exact equation for the expected active portfolio return can be derived.

Ex-Ante equation: Strategic perspective

$$E(R_A) = IC \sqrt{N} \sigma_A$$

Expected Return = Skill • Breadth • Active Risk Target

The expected active portfolio return is a product of ...

- a) transfer coefficient (TC) *IMPLEMENTATION EFFICIENCY*
- b) expected information coefficient (IC) *FORECASTING SKILL*
- c) number of securities (N) *BREADTH*
- d) active risk target (σ_A) *TRACKING ERROR*

How Much Short Extension is Enough?

Short Extension Model

Using some simplifying assumptions associated with Effective N (which is a measure benchmark concentration), the expected short extension (the “30” in a 130/30 portfolio) without costs is

$$\text{Optimal Short Ratio} = \frac{\sigma_A \sqrt{N} (1 - N_E / N)}{\sigma \sqrt{1 - \rho} \sqrt{2\pi}}$$

S&P 500 Example

N	Number of securities in the benchmark	500
N_E	Benchmark concentration as measured by Effective N	125
σ	Average security risk	30%
ρ	Average security correlation	0.20

Short Extension Model Conclusions

Besides the tracking error (active risk) target, the factors affecting the level of short extension and their impacts are:

Increase In:

- a) Average security risk
- b) Benchmark diversification
- c) Prime Broker/Trading costs

Impact on Short Ratio

- Decreases shorting
- Decreases shorting
- Decreases shorting

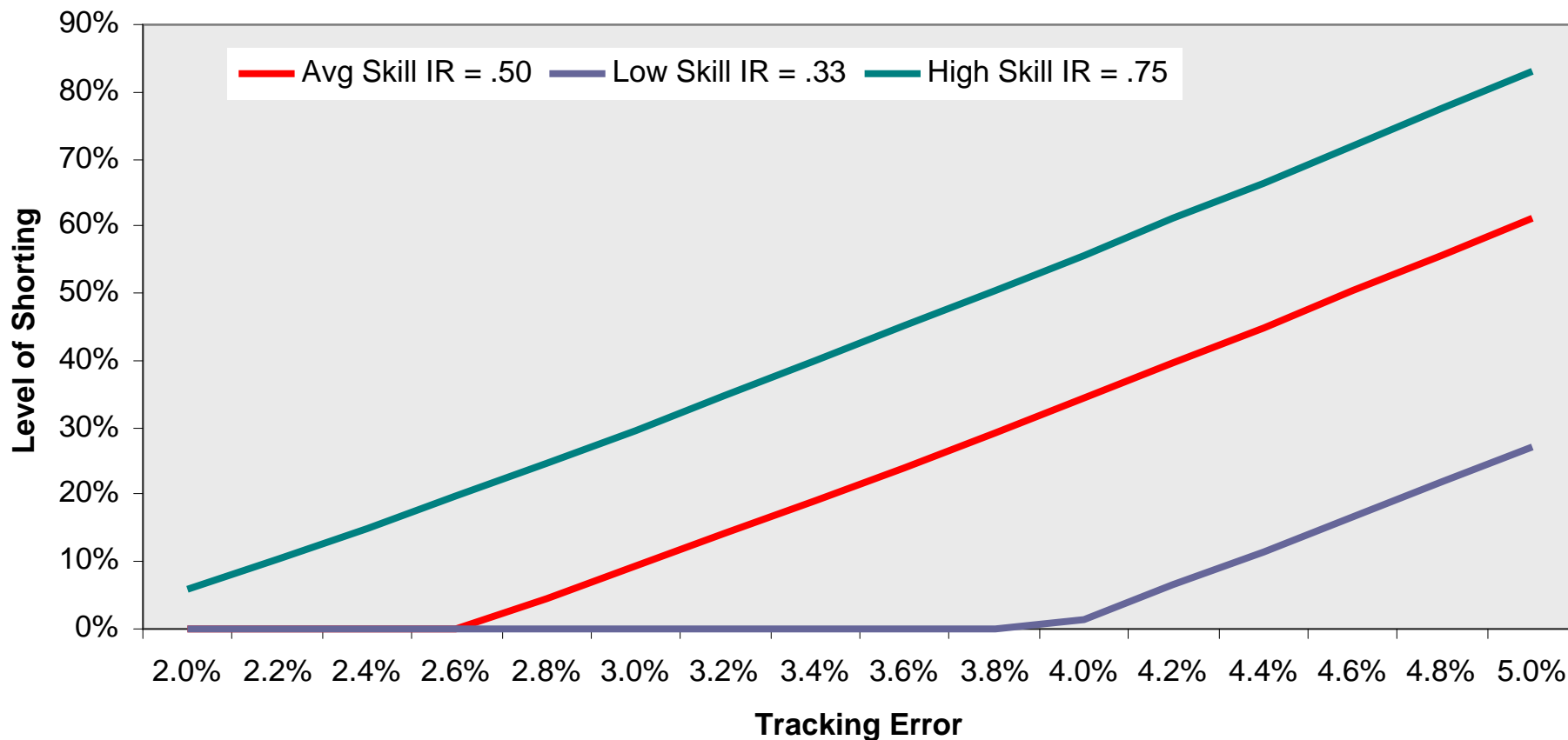


- d) Average security correlation
- e) Benchmark names
- f) Forecasting confidence (IC)

- Increases shorting
- Increases shorting
- Increases shorting

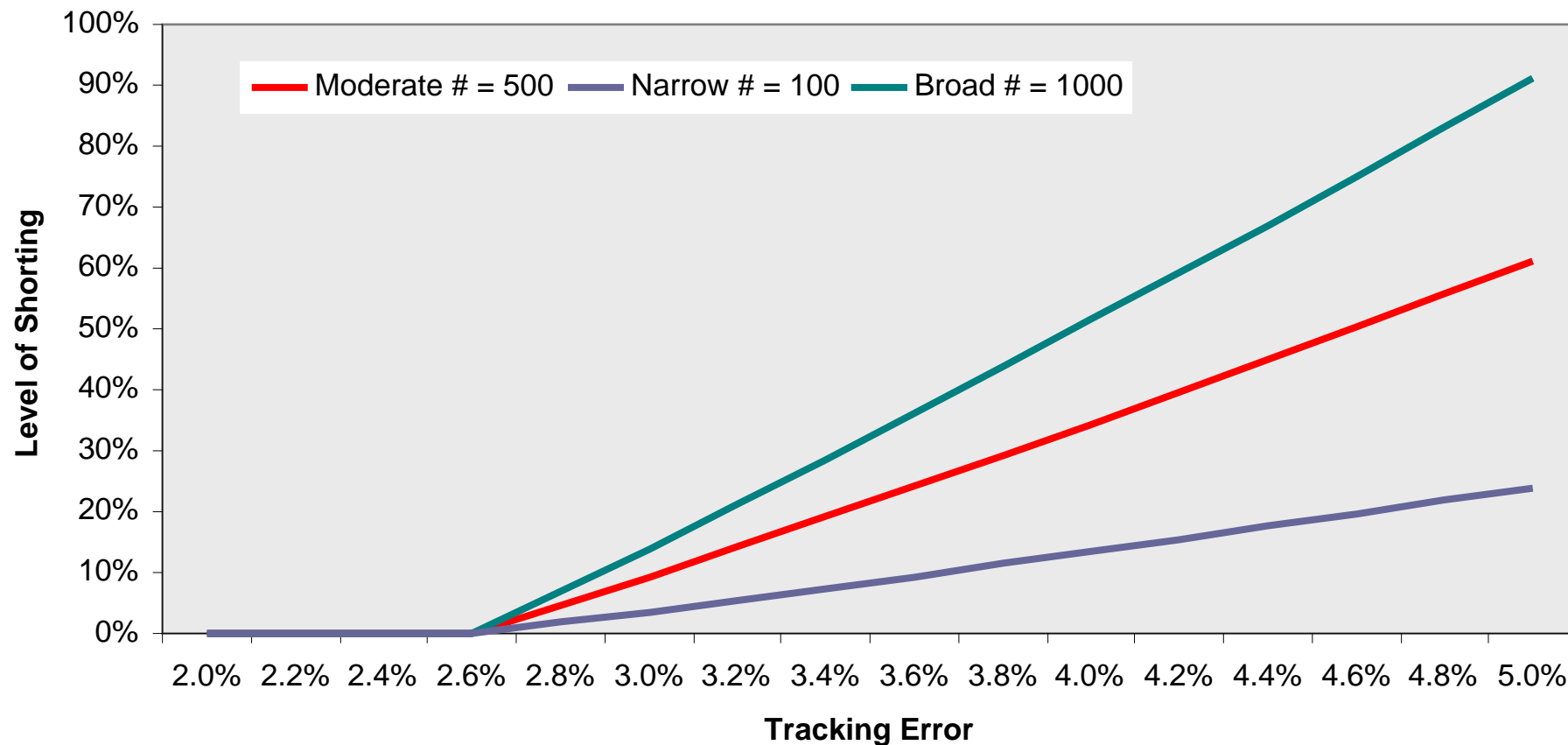


Short Extension Ratio: Manager Skill



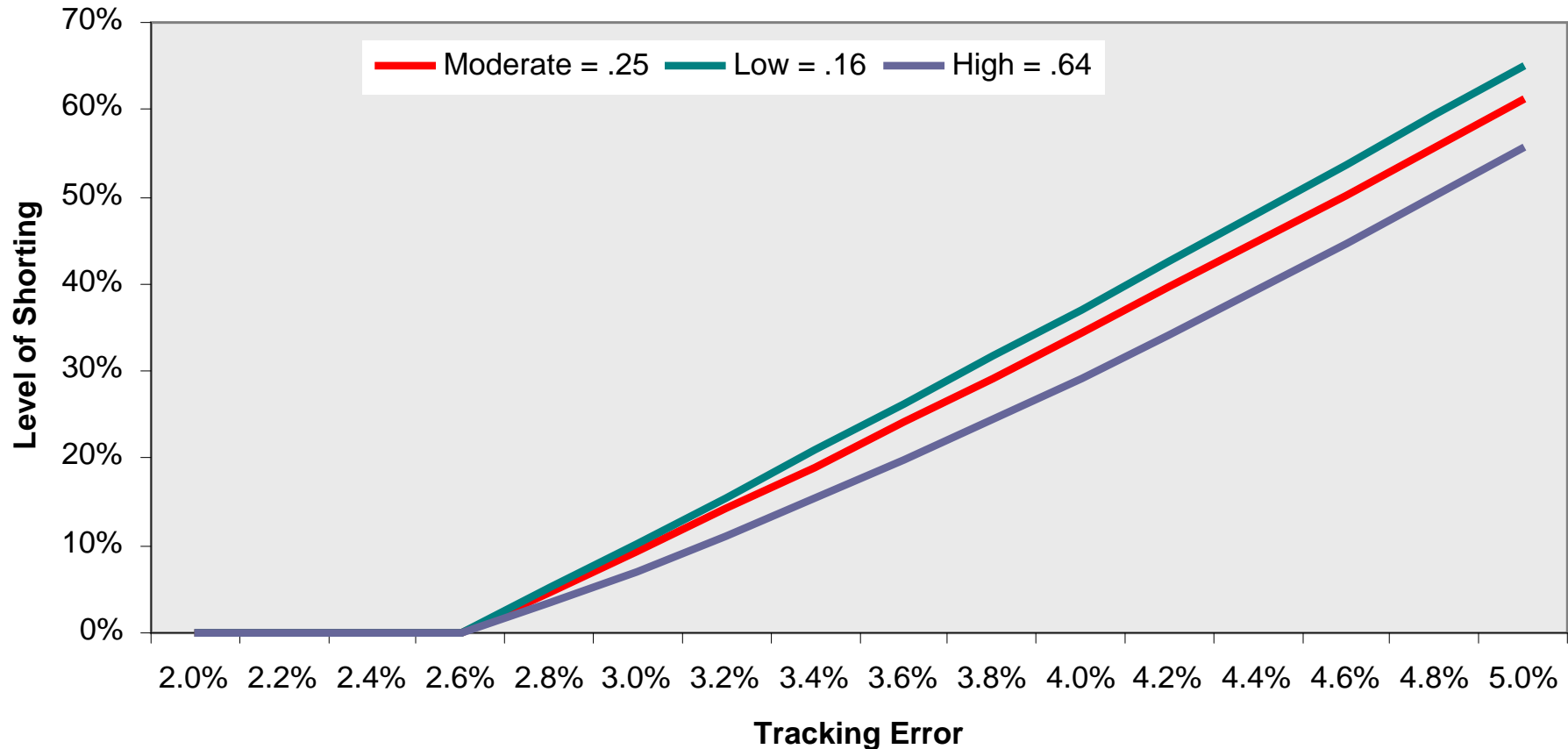
The higher the forecasting skill, the higher the optimal level of shorting

Short Extension Ratio: Benchmark Size



The broader the benchmark, the higher the optimal level of shorting

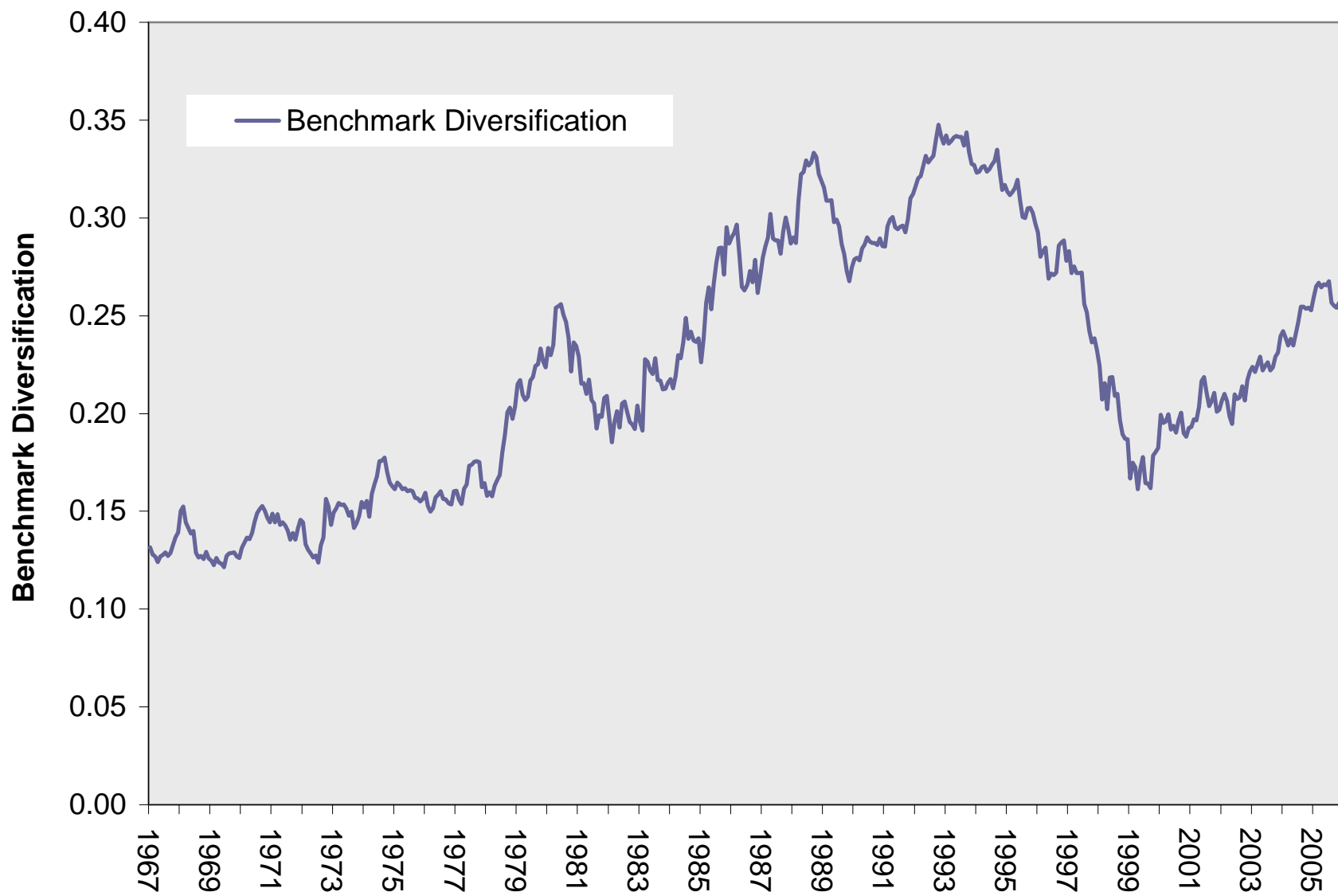
Short Extension Ratio: Benchmark Diversification (N_E/N)



N_E/N ranges from zero to one. One is perfectly diversified (equally weighted)

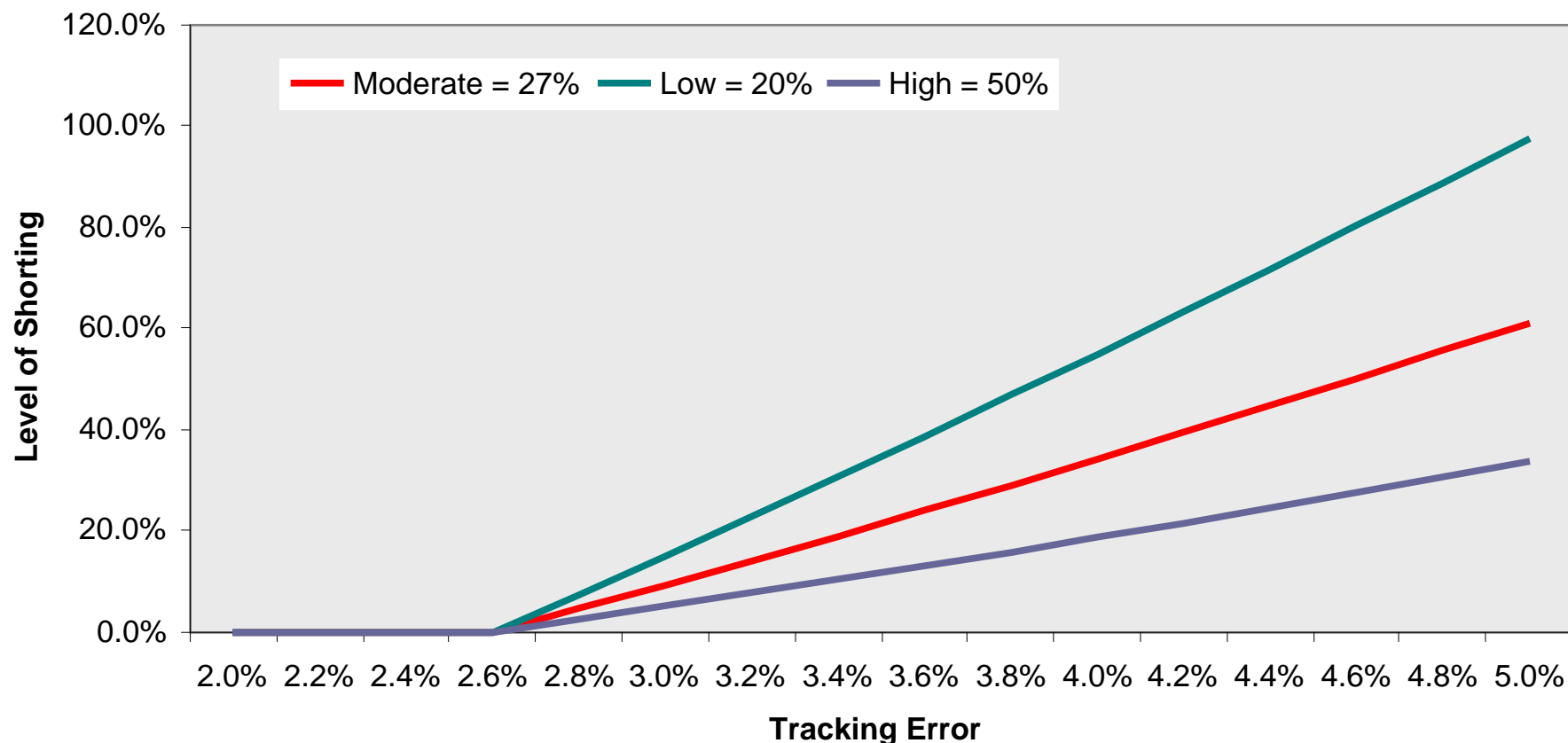
The more diversified the benchmark, the lower the optimal level of shorting

Historical S&P 500 Benchmark Diversification (N_E/N)



As of 12/31/06

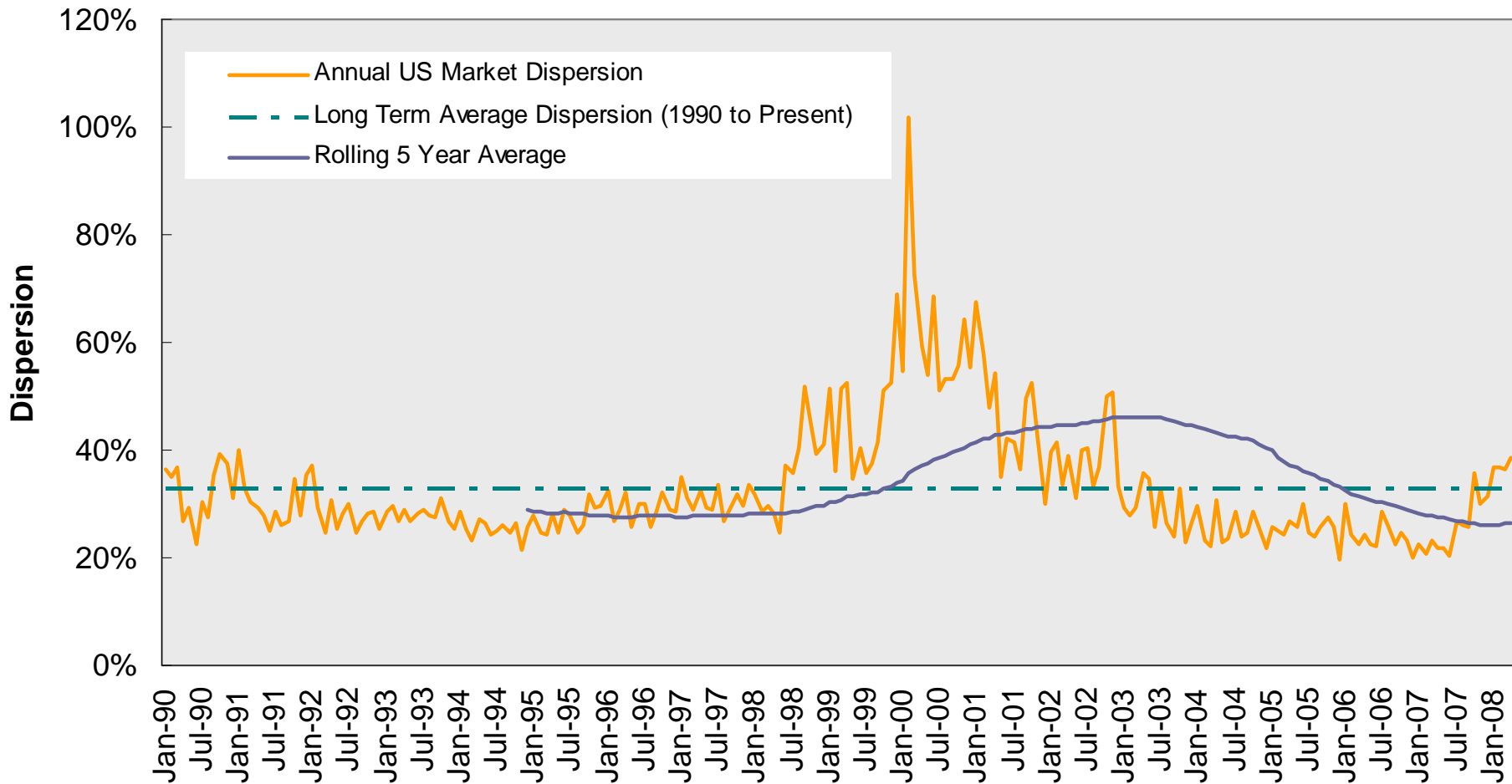
Short Extension Ratio: Dispersion



Dispersion = $\sigma \sqrt{1-\rho}$ (Dispersion encompasses security risk and correlation)

The lower the dispersion, the higher the optimal level of shorting

Dispersion in Perspective



As of 3/31/08

Optimal Shorting Level for Different Benchmarks

Assumptions: Tracking Error = 3%, Information Ratio = 0.5, Costs = 1.3%

Benchmark	Number of Securities	Effective N	N_E / N	Dispersion	Level of Shorting
S&P 500	500	129	0.26	0.270	31%
Russell 1000	987	157	0.16	0.290	45%
Russell 2000	1972	1255	0.64	0.401	39%
MSCI EAFE	1164	247	0.21	0.289	47%
MSCI Japan	382	83	0.22	0.276	26%
MSCI Europe	601	144	0.24	0.281	33%

Final Thoughts

- Target overall portfolio risk NOT the short extension ratio
 - 130/30 is not always better than 120/20
- Be aware of benchmark chosen for mandate, as its size and concentration should drive the level of short extension needed
- Be aware of changes in market dispersion and allow the manager to vary the ratio over time, with a pre-specified maximum
- Short extension is about increasing portfolio efficiency (i.e. higher IR)
- Short extension is not:
 - Leveraging up your best ideas
 - Shorting futures
 - The same IR as long-only (no increase in portfolio efficiency)



consists of seeing
what everyone has
seen and thinking
what nobody has
thought ...



Long/Short Extensions:

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