Benchmarks, Tracking, Active Management, and Performance

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9 November, 2000

Benchmark:

Portfolio reflecting the Investment Style, or strategic asset allocation which, itself, results from the risk capacity and risk tolerance of the investor.

Tracking Error:

The volatility of the „deviations“ between portfolio returns and benchmark returns, either absolute deviations, or regression residuals.

Performance:

Average return deviation, adjusted for risk and/or style, between the portfolio and the benchmark over a specific time horizon. Incorporating cash flows, fees, commissions, ...

1. Benchmarks

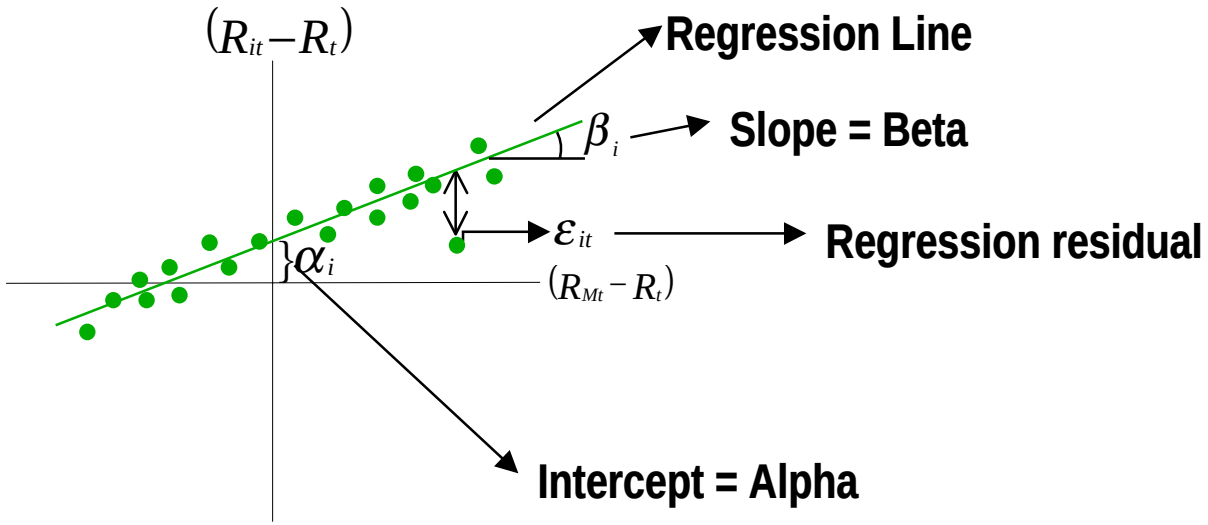
What determines a benchmark?

- The perception of losses against profits (realized vs. not-realized)
- The „objective“ risk capacity of the investor, based on A&L, cash flow forecasts, financial planning,
- The „subjective“ risk appetite/ tolerance of the investor, based on risk experience, complementary assets and income, etc.
- The appropriate aggregation level to communicate performance
- A-priori restrictions with respect to instruments, markets, sectors, etc.

Desirables properties of benchmarks:

- Must be a portfolio which can be effectively bought and sold
- Must be a passive portfolio (but what is passive?)
- The major asset categories of the benchmark should represent liquid, passive investment vehicles
- Benchmark must be determined ex-ante (obvisously...)
- Hedging strategy must be reflected in the benchmark
- The investment style of the benchmark must be known/ evaluated continusouly
- Only include assets/classes in the benchmark where the asset manager bears full responsibility with respect to performance.

2. Tracking: the statistical perspective



$R_{Mt} - R_t$: **Excess Returns of the Benchmark**

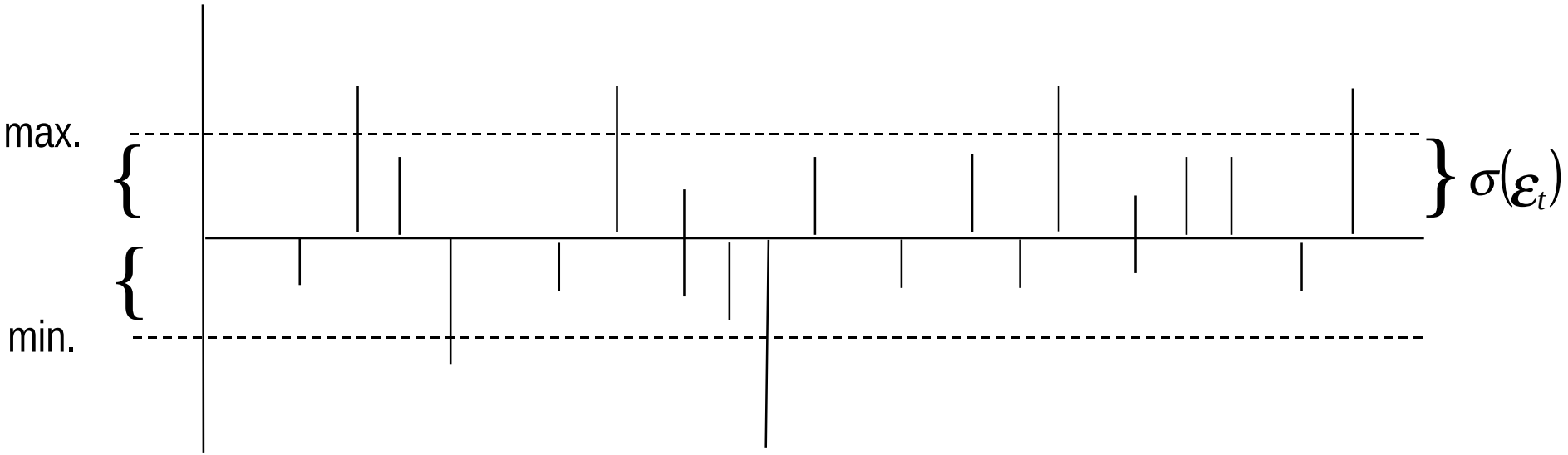
$R_{it} - R_t$: **Ecess Returns of the Fund / Portfolio**

Numerical Example:

		direkte Berechnung	indirekte Berechnung
μ_i	Average fund return	16%	
μ_M	Average benchmark return	14%	
σ_i	Volatlity of fund	30%	
σ_M	Volatility of benchmark	20%	
ρ_{iM}	Correlation fund-benchmark	0.9	
β_{iM}	Beta of fund with respect to benchmark	1.35	$\beta_{iM} = \rho_{iM} \cdot \frac{\sigma_i}{\sigma_M}$
δ_i	Jensen's Alpha of the fund	-1.5%	$\delta_i = (\mu_i - R) - \beta_{iM}(\mu_M - R)$
$\sigma(\varepsilon_i)$	Tracking Error of the fund	13.08%	$\sigma(\varepsilon_i) = \sigma_i \sqrt{1 - \rho_{iM}^2}$

Riskless interest rate R: 4%

Statistical Tracking Error



A common definition: $(R_{Pt} - R_t) = \alpha_P + \beta_P (R_{Bt} - R_t) + \varepsilon_t$

$\sigma(\varepsilon_t)$: Tracking Error (ex post)

Problems

In practice, computing regression residuals is often impossible and, thus, squared (unadjusted) return deviations are used instead.

- Why?
- What is the bias?
- Does is create adverse incentives for portfolio managers?

It is moreover questionable whether investors and portfolio managers care about squared deviations and are indifferent between positive and negative deviations. Therefore, portfolio strategies should be found minimizing

- absolute deviations from the benchmark
- downside deviations from benchmark returns.

See Rudolf/ Wolter/ Zimmermann (1999) for such a model.

3. The Practical Approach

Benchmark with normal weights and tactical „bands“

	Benchmark	Tactical Bounds		Portfolio 1
		lower	Upper	
CH Stocks	10%	5%	20%	5%
CH Bonds	40%	30%	50%	50%
INT Stocks	20%	10%	30%	10%
INT Bonds	30%	20%	40%	35%
	100%	---	---	100%

4. Combining the views

We take the following assumptions:

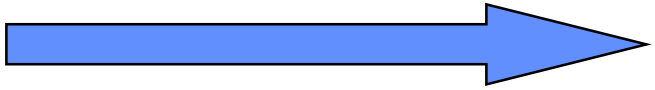
	Expected Return	Volatility	Correlations			
CH Stocks	8%	18%	1			
CH Bonds	5%	5%	0.3	1		
INT Stocks	11%	22%	0.5	0.1	1	
INT Bonds	7%	12%	0	0.4	0.2	1

We compute the following parameters:

	Portfolio B (Benchmark)	Portfolio 1
Variance	0.0063496	0.0046066
Volatility	7.97%	6.79%
Covariance to B	---	0.005105
Correlation tu B	---	0.9439
Tracking Error (based on 100%)	---	33.02%

Bounds and tracking error

OK

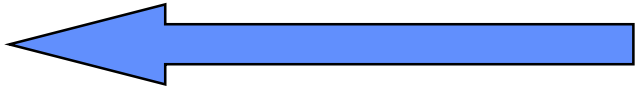


Tactical asset allocation bounds

(strategic weights plus/ minus...)

Statistical tracking error

(residual volatility, correlation)



?

See: Manuel Amman and Heinz Zimmermann (2000) for an analysis of this relationship.

Results of a simulation/optimization study

Assumptions:

Asset Class	Mean	Volatility	Correlation Coefficients				
	In %	In %	B-US	B-CAN	MSCI-JAP	MSCI-US	MSCI-EUR
B-US	9.49	5.48	1				
B-CAN	9.85	8.92	0.52	1			
MSCI-JAP	8.14	25.41	0.11	0.13	1		
MSCI-US	17.12	14.83	0.28	0.29	0.21	1	
MSCI-EUR	19.20	16.45	0.24	0.22	0.46	0.62	1
Equally weighted benchmark	*13.51*	*9.85*	*0.42*	*0.46*	*0.76*	*0.69*	*0.82*

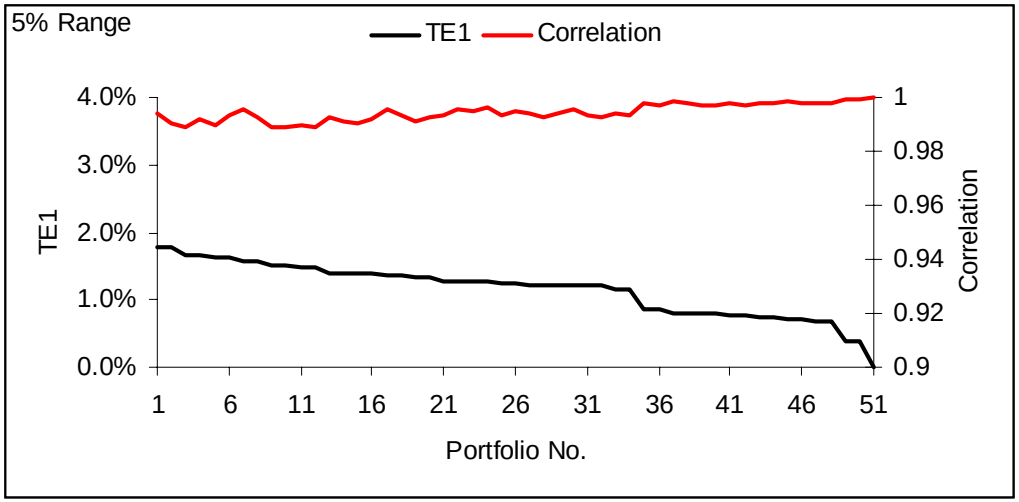
Maximiazion strategy:

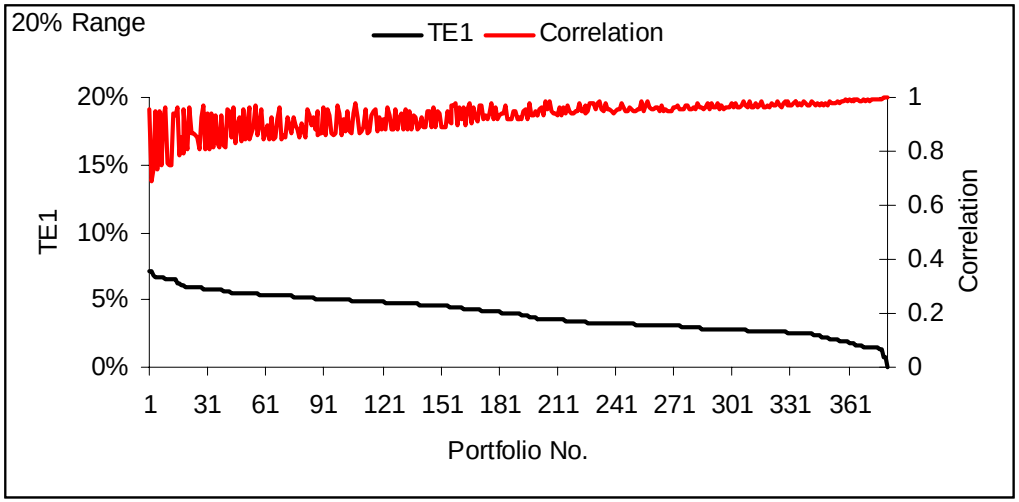
Tactical Ranges	Dynamic Strategy*				Static Strategy**
	Maximized Tracking Error TE1 in %	Correlation to Benchmark of the TE1-maximizing strategy	Tracking Error TE2 of the TE1-maximizing strategy in %		Maximum TE1 of static allocation in %
5%	*2.31*	0.9723	2.27		*1.79*
10%	*4.61*	0.8900	4.46		*3.57*
20%	*9.32*	0.8140	8.91		*7.16*
Unconstrained	*21.12*	0.7521	18.11		*18.99*

**Each month the portfolio is reallocated such as to maximize TE1 subject to the portfolio weight constraints in column 1.*

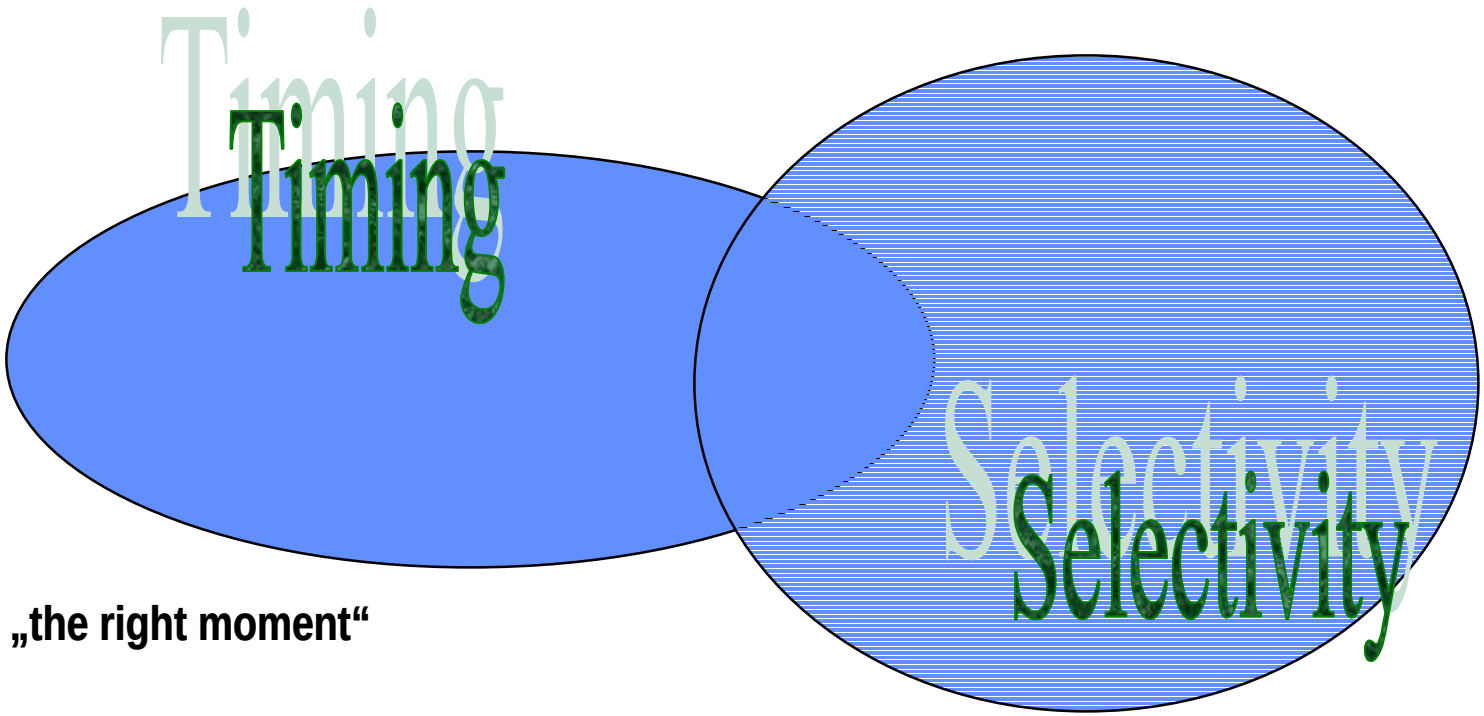
***No portfolio reallocation.*

The relationship between tracking error, correlation and TAA-bounds, based on simulation





5. Active Portfolio Management



„the right moment“

„the right stock, market, sector ...“

Separating the impact on performance

Practical and widespread model: The Brinson/ Hood/ Beebower model

See the review article by Zimmermann (1992) for a numerical eample

Problems:

- Adjustment for risk
- Interpreting and assigning the cross-terms
- Requires information about portfolio weights
- Integrating currency risk

6. „Law“ of Active Management (Grinold)

The „law“ postulates three determining factors of the *ex ante* alpha of a portfolio:

1. ***The Tracking Error***
2. ***The Frequency of Forecasts***
3. ***The Quality of Forecasts***

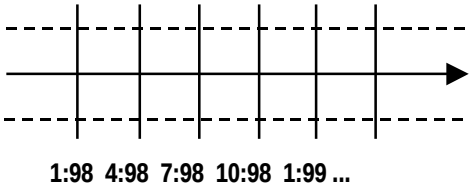
Law of active management: Die Formel

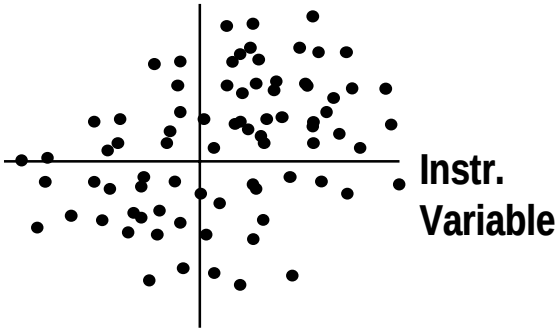
Number of independent forecasts per time unit

Forecast quality.

Residual volatility/ Tracking error

Alpha (ex ante) = $\sqrt{N}$ x IC x σ_ε (ex ante)





Numerical example:

N	IC	τ_ε	Alpha
4	0.5	5%	5%
12	0.5	5%	8.66%
12	0.3	5%	5.20%
12	0.3	3%	3.12%
12	0.3	10%	10.40%

Notice: It is not a „law“ in the mathematical sense but rather a relationship based on several approximations.

A note on terminology

Information coefficient

... refers to the informational content of the forecasts on which an active strategy is based. It is typically measured by the correlation coefficient between predictions and realizations.

Information ratio

... refers to the ecess return of an active portfolio with respect to the benchmark, divided by the tracking error. In a regression based performance measurement framework, it is the alpha divided by the specific volatility of the portfolio, i.e. the Appraisal ratio suggested by Black/ Treynor (1971).

7a. Example - Stock market timing based on TS

Oertmann/ Zimmermann (1997): Wieviel Noise erträgt ein Prognosemodell für die taktische Asset Allocation? Finanzmarkt und Portfolio Management

- Tactical asset allocation between stocks and liquidity based on term spreads.
- Term spread: 3-1m, 6-1m, 12-1m, 120-1m
- Stock market: Switzerland
- Estimation period: Rolling four year time window from 1:1985-12:1988 to 2:1993-1:1997, a total of 98 regression equations.
- Forecasting rule: The stock market is predicted for one month ahead based on the most recent term spread; if the forecast exceeds the riskfree rate, then 100% of the wealth is allocated to stocks; if not, the wealth is allocated riskfree.
- Reallocation rule: Monthly, over the time period Jan 1989 to February 1997, i.e. 98 times.

Instrumental-variable	Durchschnittlicher Regressions-koeffizient	Anzahl negativer Regressions-koeffizienten	Durchschnittlicher R^2-Wert
TERM1	-8.16	98	8.8%
TERM2	-3.65	98	4.6%
TERM3	-2.17	97	3.9%
TERM4	0.09	60	1.5%

** Die zugrundeliegenden 98 Regressionsgleichungen beruhen auf einem gleitenden Vierjahreszeitfenster von 1:1985-12:1988 bis 2:1993-1:1997.*

Oertmann/ Zimmermann (1997)

	Ueberschussrendite und Risiko				CAPM-Performance			
	Mittelwert	Volatilität	Sharpe Ratio	Endwert*	Jensen α	Markt β	R^2	App. Ratio
Buy-and-hold								
Aktien	11.57%	16.37%	0.70	244.58				
TAA-Strategien								
Instrument: 3M-1M-Spread (TERM1)								
ohne TAK	14.43%	14.72%	0.98	300.70	4.61% *2.07*	0.81 *21.94*	0.83	0.75
mit TAK	13.31%	14.79%	0.90	277.54	3.52% *1.60*	0.83 *21.94*	0.83	0.57
Instrument: 6M-1M-Spread (TERM2)								
ohne TAK	12.29%	14.50%	0.85	257.71	3.01% *1.24*	0.78 *18.99*	0.78	0.44
mit TAK	11.41%	14.53%	0.79	241.71	2.19% *0.91*	0.79 *19.04*	0.79	0.33

Oertmann/ Zimmermann (1997)

Evaluation

- Information coefficients: take the square root of the R^2-values of the term spread regressions, and get 0.30, 0.21, 0.20 and 0.12 for the 4 maturities.
- If *n* denotes the number of independent forecasts per annum on which the TAA strategy is based. Here, n=12.
- Based on the Law of Active Management, we get the following Appraisal Ratios: 1.04, 0.73, 0.69, and 0.41.
- The actual values are lower, namely 0.75, 0.44, 0.61, and 0.12.

$$\text{Appraisal Ratio} = IC \times \sqrt{n}$$

7b. Example - TAA based on momentum

Recent evidence: Chan/ Jegadeesh/ Lakonishok (1999), Financial Analysts Journal

Contrarian strategies:

„Past winners are future losers - and reverse“; i.e. negative persistence

true for long term strategies (3-5 y)

Momentum strategies:

„Past winners are future winners - and reverse“; i.e. positive persistence

true for medium term strategies (3m to 1y)

8. Balanced vs. switching strategies

Compare the two following strategies:

- „Half stocks all the time“: Invest 50% riskfree and 50% stocks and keep the ratio constant over time
- „All stocks half the time“: Invest 100% in stocks half the time (no specific rule required) and 100% riskfree in the other half of the time period.

Should one strategy be prefered? The stock exposure is the same in both cases, true?

Simulation results are provided by Kritzmann (2000), chap. 5.

Risk and return of the two strategies

We investigate the expected return and risk of the two strategies:

- „Half stocks all the time“:

$$\mu_{Bal} = 0.5 \times \mu_S + 0.5 \times R$$
$$\sigma^2_{Bal} = 0.5^2 \times \sigma^2_S$$

- „All stocks half the time“:

$$\mu_{Sw} = 0.5 \times \mu_S + 0.5 \times R$$
$$\sigma^2_{Sw} = 0.5^2 \times \sigma^2_S + \underline{0.5 \times 0.5 \times [\mu_S - R]^2}$$

Formula by Clarke/de Silva (1998)

Numerical example

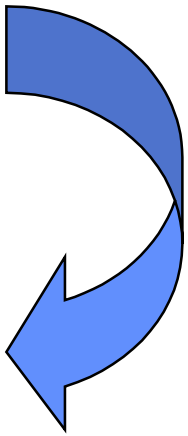
Assumptions: US stock market, 1979-1998, average stock return = 18.44%, riskfree rate = 5%.

- „Half stocks all the time“:

$$\mu_{Bal} = 11.76\%$$
$$\sigma^2_{Bal} = 6.32\%$$

- „All stocks half the time“:

$$\mu_{Sw} = 11.76\%$$
$$\sigma^2_{Sw} = 10.95\%$$



Numerical example cont.

The „switching“ strategy must provide a higher return in order to compensate for the higher risk.

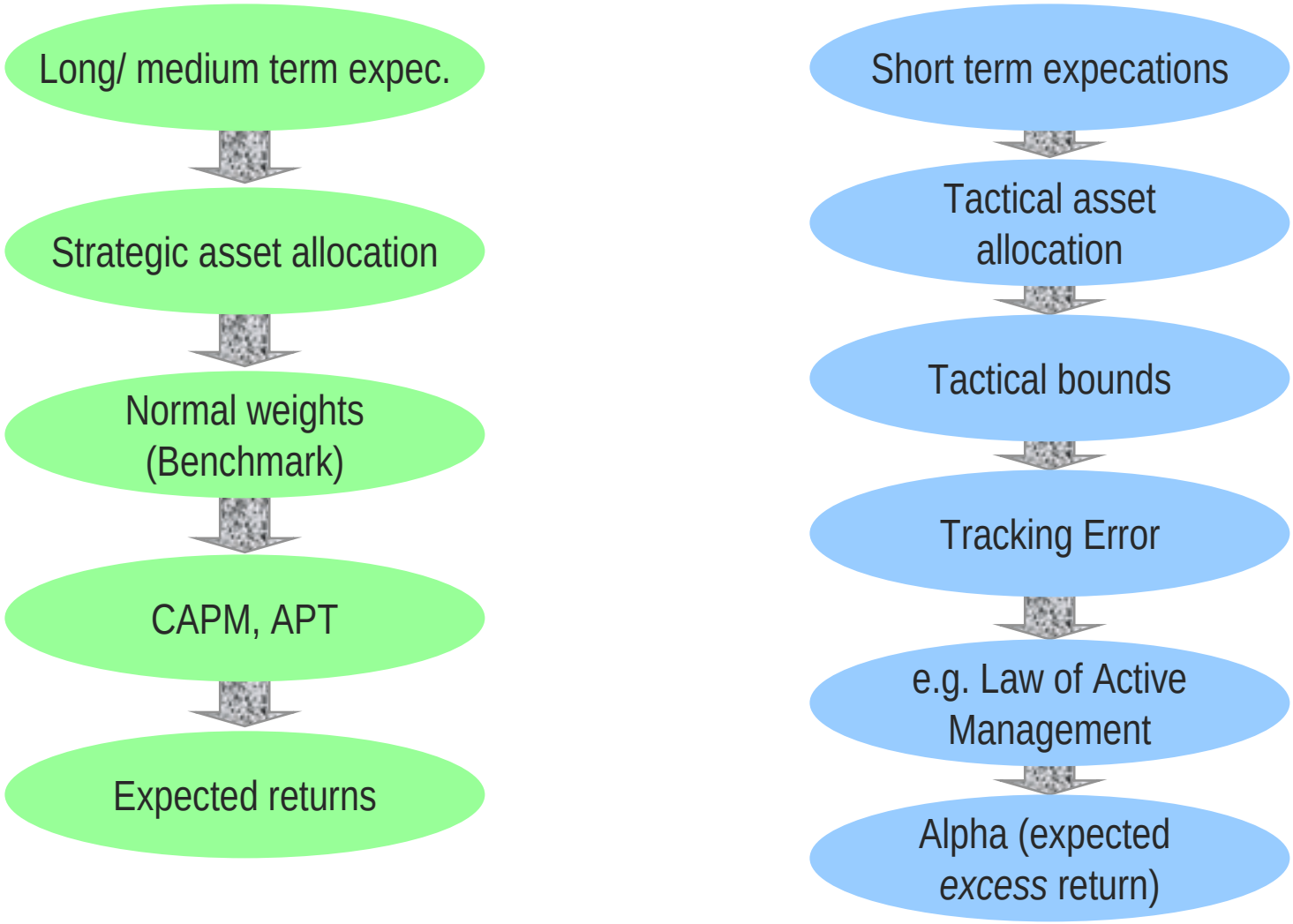
How big should the extra return of the switching strategy be for the Sharpe ratios to be equal? (this is a little bit a problematic requirement, however. Why?)

$$\frac{11.76\% - 5\%}{6.32\%} = \frac{11.65\% + \alpha - 5\%}{10.95\%}$$

$$\rightarrow \quad \alpha \approx 5\%$$

i.e. the switching strategy must generate an extra return of 5% p.a. How would you interpret this number based on the law of active management?

9. Summary


Long/ medium term expec.
Strategic asset allocation
Normal weights (Benchmark)
CAPM, APT
Expected returns
Short term expecations
Tactical asset allocation
Tactical bounds
Tracking Error
e.g. Law of Active Management
Alpha (expected excess return)

10. References

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