ECON4510 Finance Theory, Lecture 9

Performance measurement: methodology

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Notes adapted from Prof. Thore Johnsen (NHH)

Evaluating portfolio managers

- **Performance measurement and evaluation**
  - **Benchmarking**
    - **traditional peergrouping**
    - **Risk adjusted return measurement**
  - Interpretation of historical returns

- **Statens pensjonsfond SPN & SPU**

Traditional evaluation (‘peer grouping’)

- Relative ranking of portfolio managers on period return
  - Distinguish PM type, asset class and investor “style”
  - present ranking for different period length
- Problemes
  - ‘survivorship bias’: adjust for exit and entry in period
  - ‘small-portfolio bias’: no size adjustment implies that sample is dominated by small-cap assets
- General
  - ex post vs ex ante: what does history imply?
  - Risk differences: what’s skill and what’s gearing?

Sharpe's (1991) "arithmetic of active management"

- "it *must* be the case that

I. before costs, the return on the average actively managed dollar will equal the return on the average passively managed dollar,

II. after costs, the return on the average actively managed dollar will be less…

- These assertions will hold for *any* time period. Moreover, they depend *only* on the laws of addition, subtraction, multiplication and division. Nothing else is required."

Investment outcome = Skill + Luck

- Amos Kahneman's «Thinking Fast and Slow»: Yearly rankings of 25 investment advisors for 8 years
- Average of 28 pairwise correlations = 0.01

År sammenlignet		Korrelasjon
2009	2010	0,15
2009	2011	-0,01
2009	2012	0,27
2009	2013	0,32
2009	2014	-0,07
2010	2011	-0,43
2010	2012	0,23
2010	2013	-0,18
2010	2014	0,13
2011	2012	-0,44
2011	2013	0,06
2011	2014	-0,46
2012	2013	-0,06
2012	2014	0,33
2013	2014	0,32
Gjennomsnitt		**0,01**

2015 DNgrafikk/Kilde: Prof. Ola Kvaløy/Oslo Børs VPS

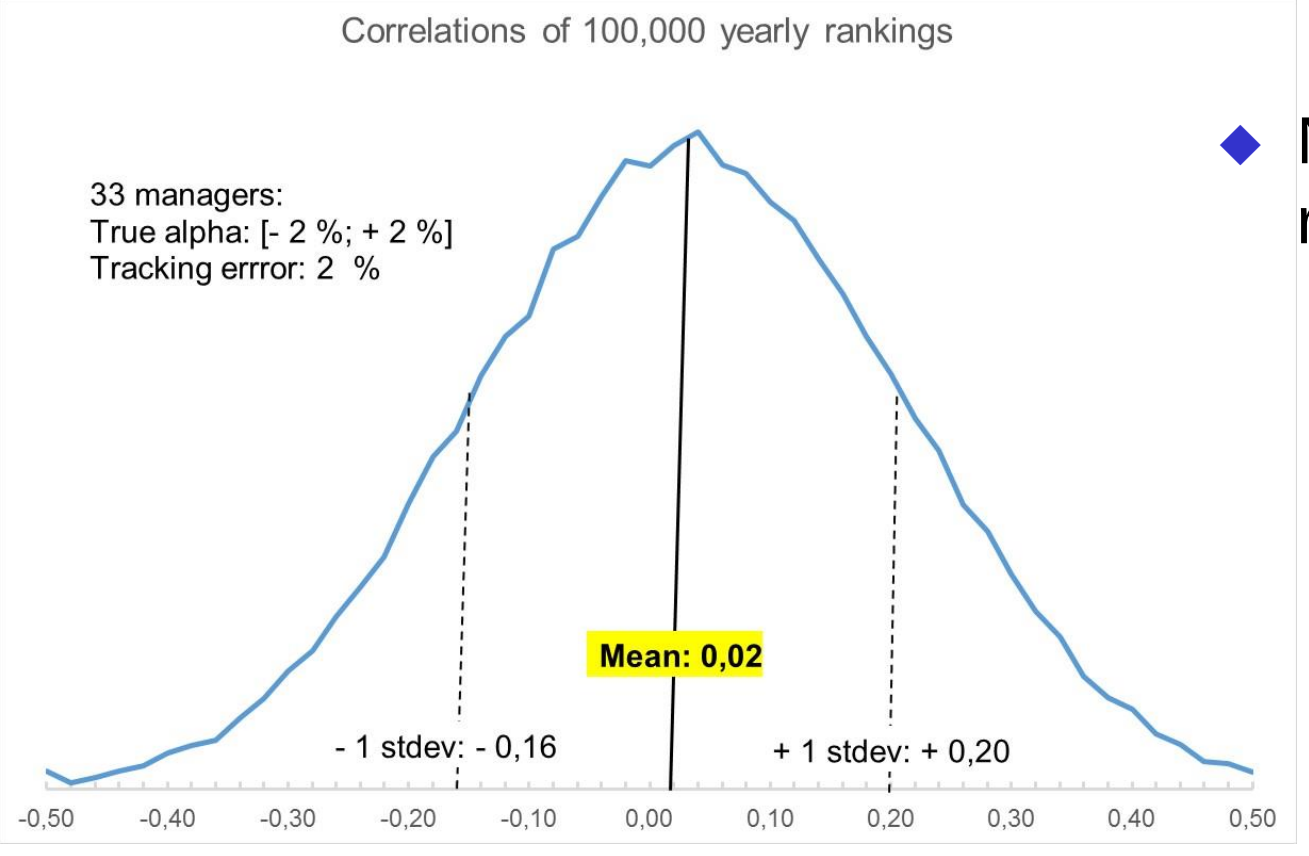
DN, 15 April 2015

- Replicated on 6 yearly rankings of 33 Active Norwegian mutual funds (2009 – 14) by prof. Ola Kvaløy
- Avg. Corr. = 0.01 of the 15 pairs

- Two claims about active managers:
  - They are paid for luck not skill
  - They can't beat the market (?)

«Mean Veil»: You can only *estimate* the risk

- 33 managers: True **alpha** uniformly distributed between - 2 % and + 2%. common tracking error (**TE**) 2 %.
- Information Ratio (IR = Alpha/TE) between –1.0 and +1.0
  - ⇒ Need relatively few years to separate the truly good from the truly bad



- No infomation in yearly rankings

Measurement relative to benchmark index

- Difference return and -risk
- Why?
  - Distribute responsability on owner and manager
  - Defines portfolio manager’s choice set
  - Comparisons over time between managers
  - Attribution analysis
    - Security selection, allocation, currency

Risk adjusted performance measures

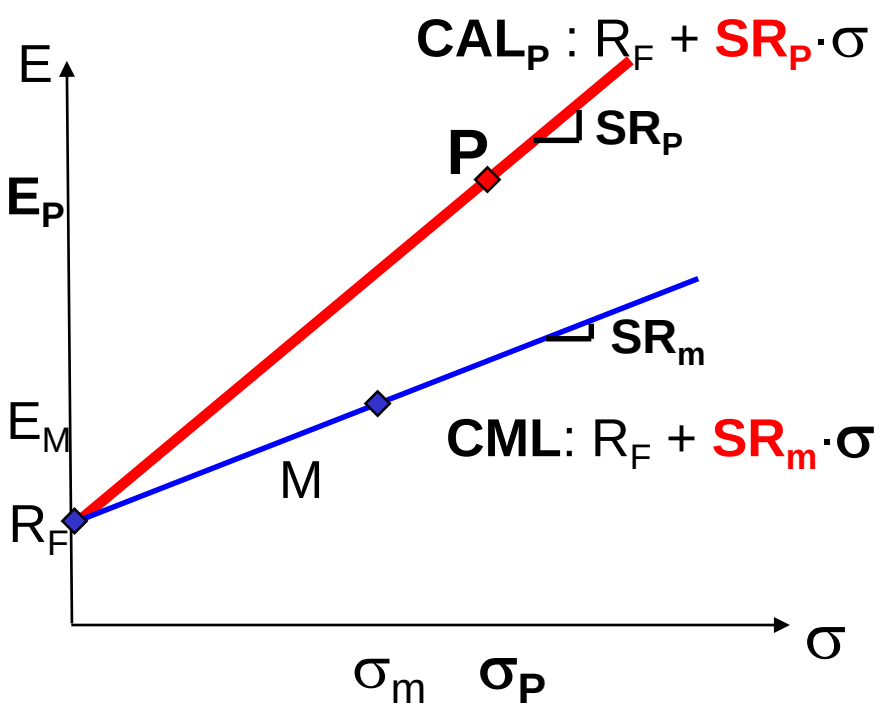
- Absolute return/risk (vs risk free); macro measures:
  - Sharpe (SR)
    - Modligiani^2 (M^2)
  - *Morningstar (relative peer-group)*
- Relative return/risk (vs benchmark); micro measures
  - Treynor (TR)
    - ajusted (TR*)
  - Alpha
  - Information rate (IR)
    - Appraisal ratio (AR)

Performance measure 1: Reward to variability

- Macro level
- Max SR ⇔ M-V preferences

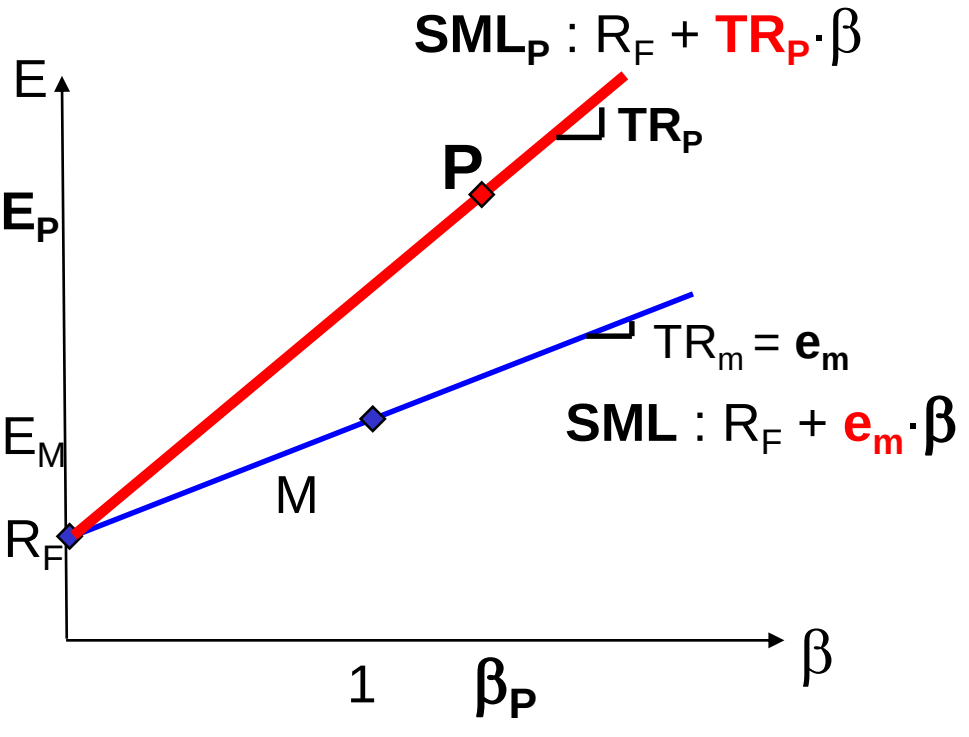
- Micro level; diversified owner
- Max TR ⇔ CAPM

Sharpe



- ”Reward to variability”:
  SR = e / **σ**

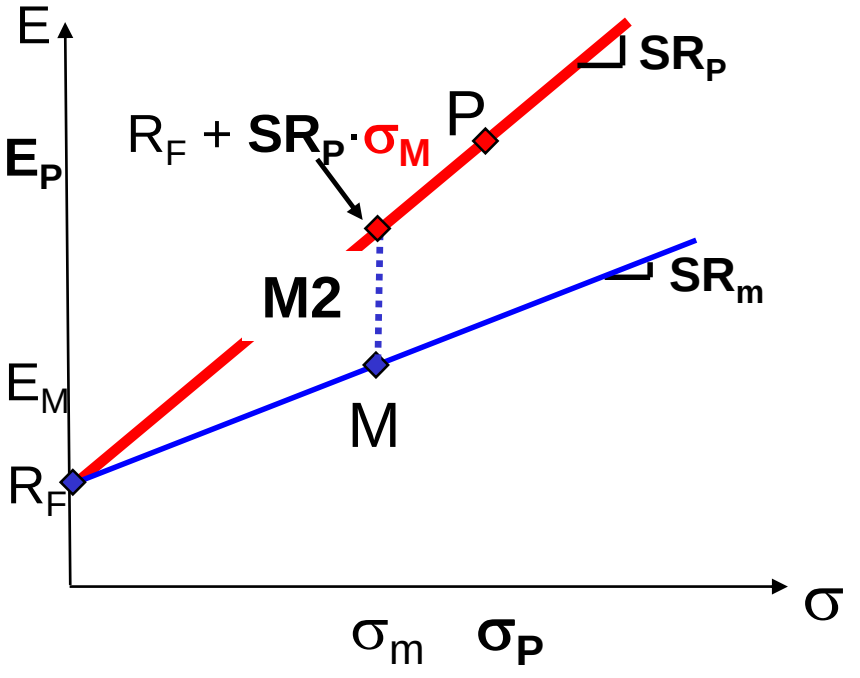
Treynor



- ”Reward to β-variability”:
  TR = e / **β**

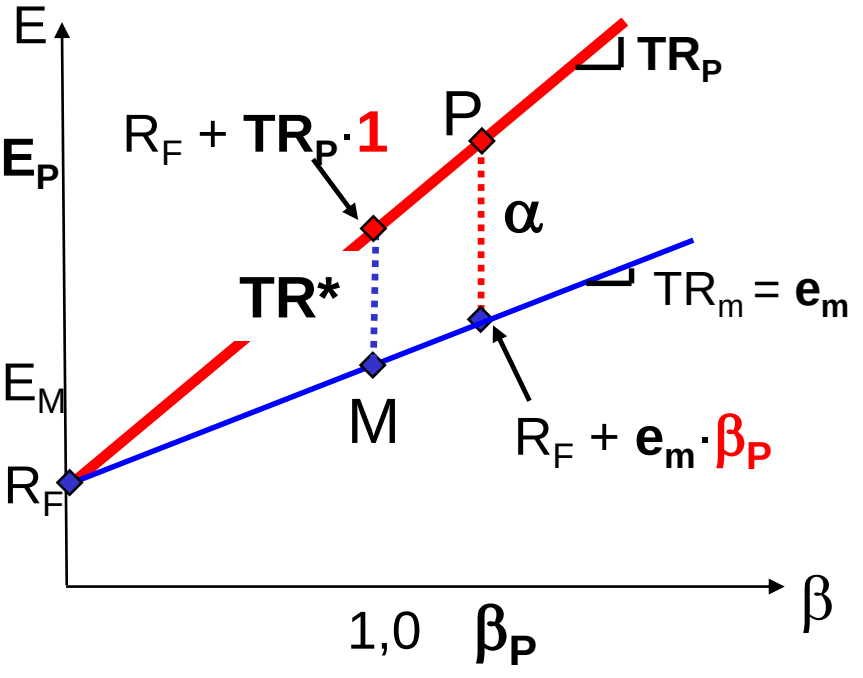
Performance measure 2: Risk Adjusted Performance

M2
(rel. σ_M)



- M2 $= e_P \cdot (\sigma_m/\sigma_P) - e_m$
  $= [SR_P - SR_m] \cdot \sigma_m$

Alpha vs Treynor*
(rel. β_P) (rel. β_M)



- TR* $= e_P/\beta_P - e_m$
  $= [TR_P - e_m] \cdot \mathbf{1,0}$

- $\alpha = e_P - e_m \cdot \beta_P$
  $= [T_P - e_m] \cdot \beta_P$

Perfomance measure 3: IR and AR

- Information rate (IR) scales active excess return by active risk; '**tracking error**'

  (both measured ralative to benchmark portfolio)

$$IR_P \equiv \frac{\overline{R}_P - \overline{R}_B}{\sigma(\tilde{R}_P - \tilde{R}_B)}$$

- Appraisal Ratio (AR) scales alpha by diversifiable risk

$$AR_P = \frac{\alpha_P}{\sigma(\varepsilon_P)}$$

'Signal to Noise'

$$\alpha_P + \tilde{\varepsilon}_P = \tilde{R}_P - (R_F + \boldsymbol{\beta_P} \cdot [\tilde{R}_B - R_F])$$

$$= \tilde{R}_P - \tilde{R}_B \quad ;\text{if } \boldsymbol{\beta_P} = \boldsymbol{\beta_B}\,1$$

IR vs AR

$$\tilde{R}_P - \tilde{R}_B = \alpha + \tilde{\varepsilon}_P + (\beta_P - \beta_B)\cdot[\tilde{R}_M - R_f]$$

- General

Diversified B

$$IR_P = \frac{\alpha_P + (\beta_P - \beta_B)\cdot e_M}{[\sigma(\varepsilon_P)^2 + (\beta_P - \beta_B)^2 \cdot \sigma_M{}^2]^{1/2}}$$

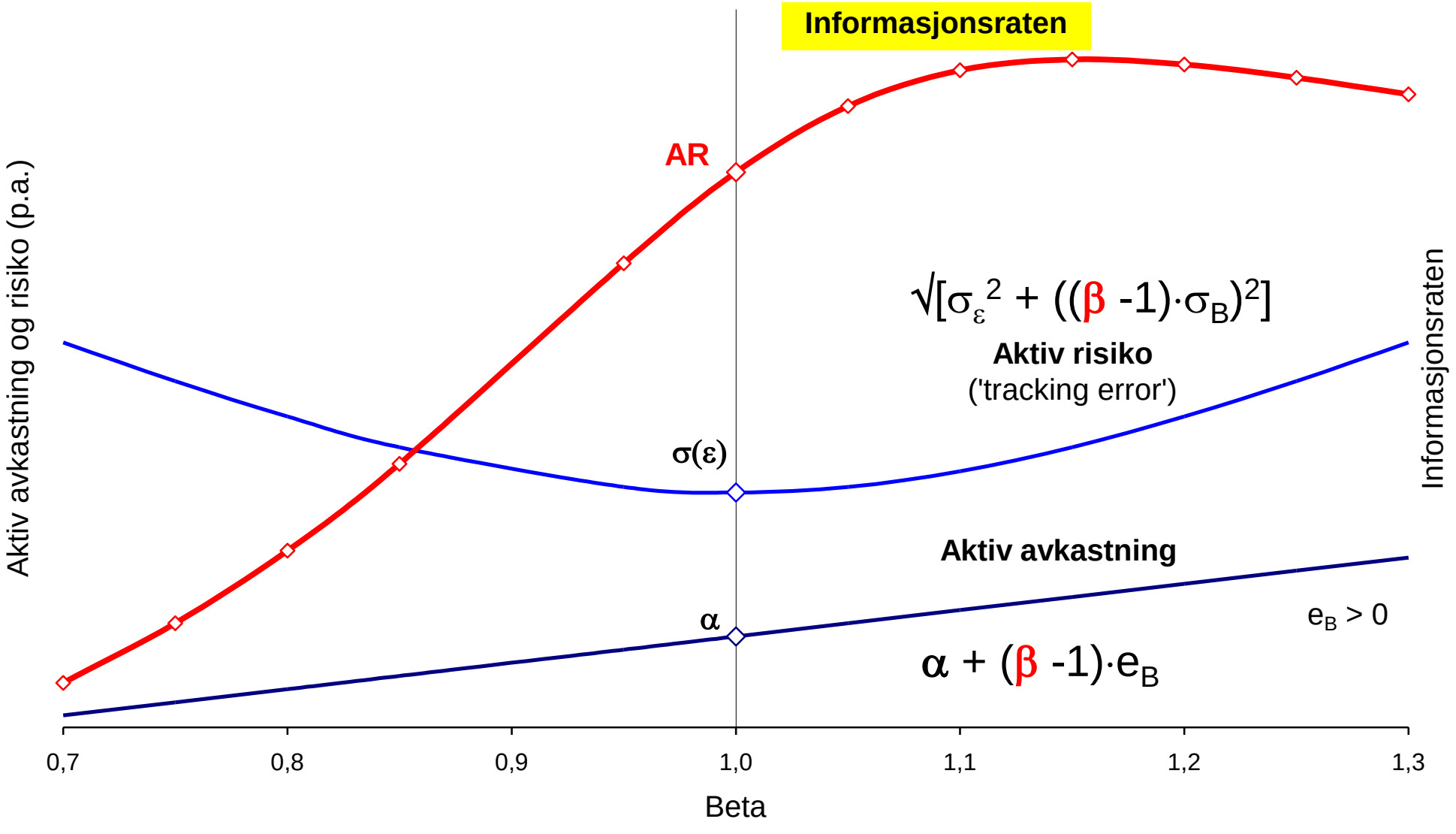
- Only alpha-bets ($\beta_P = \beta_B$)

$$IR_P = \frac{\alpha_P}{\sigma(\varepsilon_P)} = AR_P$$

- Only beta-bets ($\sigma(\varepsilon_P) = 0 = \alpha_P$)

$$IR_P = \frac{e_B}{\sigma_B} = SR_B$$

Beta factor in IR



Sharpe - Alpha - Treynor - Appraisal - IR

- SR / TR / IR: owner gears excess return by borrowing/lending at R_f

⇒ Alpha: sign is most interesting (on its own)

- SR / IR: macro level
- Treynor / Alpha / IR / AR: micro level (subportfolios)
  - Treynor/Alpha: total portfolio is diversified
  - IR / AR: subportfolios taking bets over and above indexed core portfolio (’core’ + ’satelites’)
- Max SR / TR / IR: can active portfolio be scaled?

⇒

1. Free shorting benchmark (e.g. risk free debt)
2. No obstacles to scaling active management

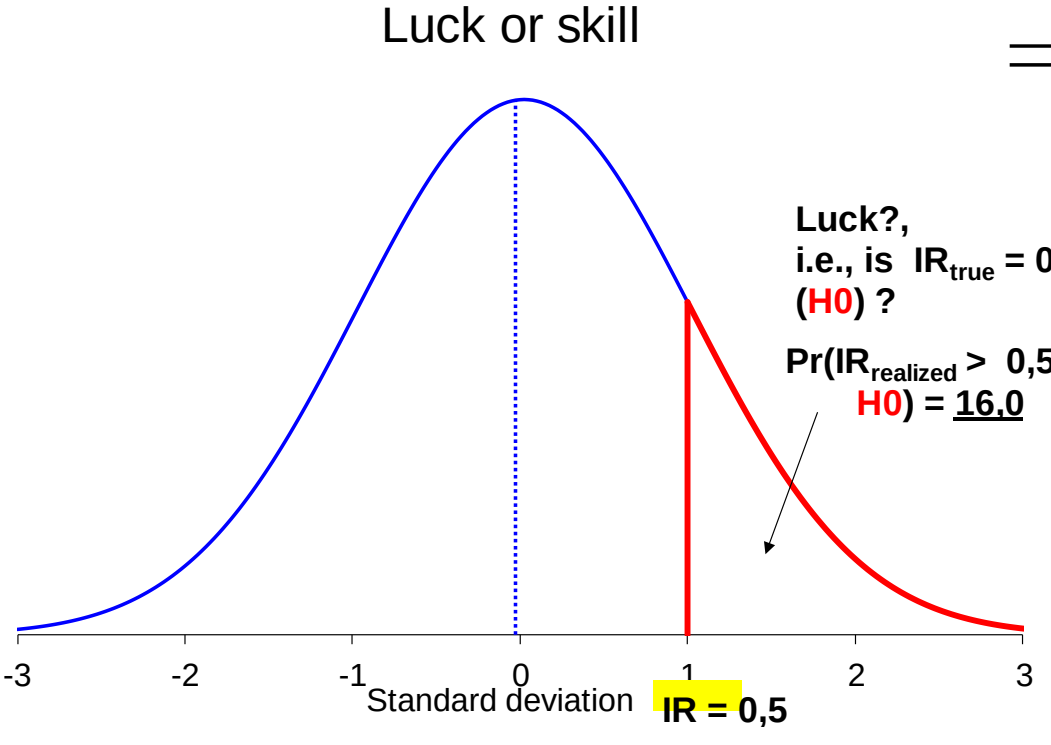
Is manager skilled? $E(R - R_B) = \mathbf{E(r) > 0}$?

- Measured average excess return $\bar{r}$

$$t_{\bar{r}} = \frac{\bar{r}_P}{\sigma(\tilde{r}_P)/\sqrt{n}} = \mathbf{IR} \cdot \sqrt{n}$$

Example: **IR = 0,5** and **n = 4**

$\Rightarrow$ $t = 0{,}5 \cdot \sqrt{4} = \underline{1{,}0}$



Approx. $Pr(IR >= 0{,}5 \mid IR_{true} = 0)$

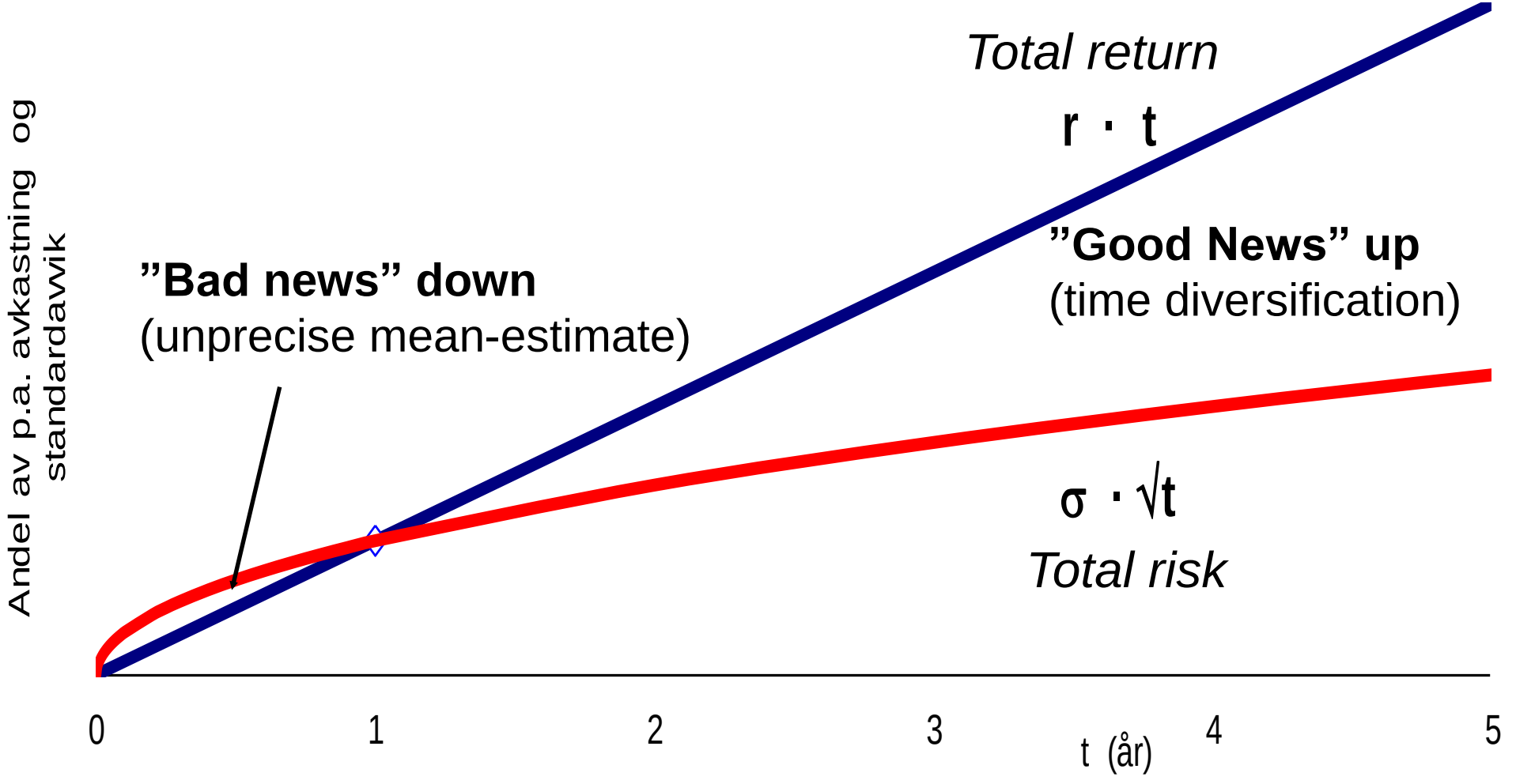
$\cong 50\% - t \cdot \mathbf{34\%} = \underline{\mathbf{16\%}}$

Using normal distribution,
since precicely estimated std.dev

Does more frequent measurement help?

- Use e.g. monthly or quarterly data
- Increases precision of estimate for risk (std. deviation)
  - More information about variance of process
- … but does not improve estimate of average return
  - **more, but less precise observations**
  - (geometric return requires only initial and terminal value)

Time effect for std. devation: slow both up and down



- Shorter return period ⇒ Std.deviation increases relative to average ⇒ Reduced precision in measuring average

How many observations do we need for precision?

	Quarter	Year	
	IR		
#obs	**0,25**	**0,5**	**1,0**
1	0,25	0,5	1,0
4	0,5	1,0	**2,0**
16	1,0	**2,0**	4
25	1,25	2,5	5
64	**2,0**	**4**	8
400	5	10	
625	6		

$$T_{\bar{r}} \approx IR_{periode} \cdot \sqrt{\#obs}$$

$$\mathbf{T_{kv}} = IR_{kv} \cdot \sqrt{\#kv}$$

$$= \frac{IR_{år}}{\sqrt{4}} \cdot \sqrt{4 \cdot \#år} = \mathbf{T_{år}}$$

Attribution analysis

Table 33 Contributions to fund relative return from investment strategies for 2013–2018. Annualised. Percentage points

	Equity management	Fixed-income management	Real estate management	Allocation	Total
Fund allocation	-0.07	-0.10	0.04	0.02	-0.10
Reference portfolio	-0.01	-0.09		0.00	-0.11
of which systematic factors	0.01				0.01
Allocations	-0.05	0.00	0.00	0.02	-0.03
Real estate			0.04		0.04
Unlisted real estate			0.05		0.05
Listed real estate			-0.01		-0.01
Security selection	0.10	0.01			0.10
Internal security selection	0.00	0.01			0.00
External security selection	0.10				0.10
Asset management	0.10	0.08		0.01	0.18
Asset positioning	0.06	0.07		0.01	0.14
Systematic factors[1]	-0.02	0.00			-0.02
Securities lending	0.05	0.01			0.06
Total	**0.13**	**-0.01**	**0.04**	**0.03**	**0.18**

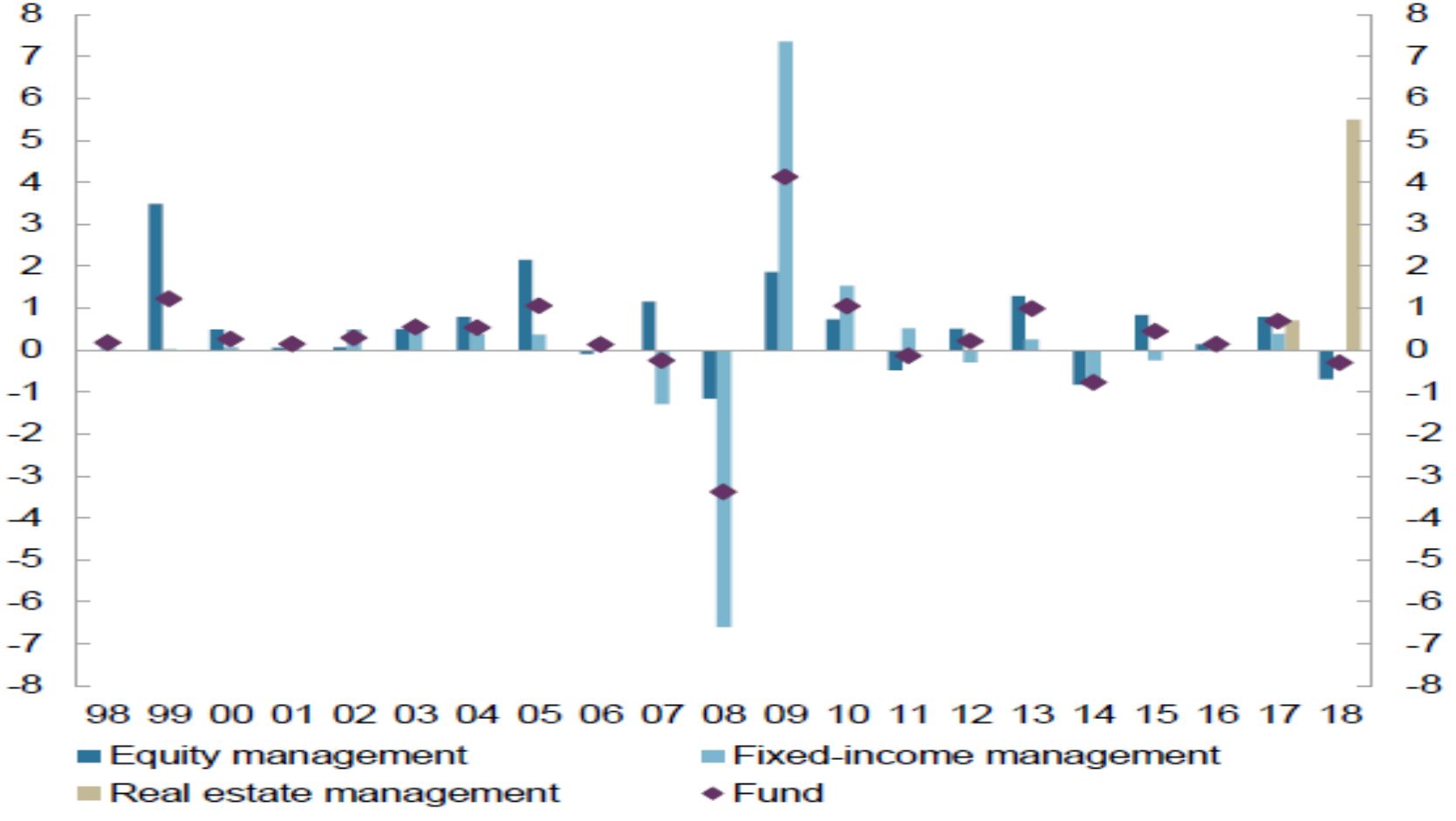
[1] Systematic factors as a sub-strategy of Asset management was added in 2018.

Relative returns, NBIM

			Average %-USD relative returns		
	Start	End	Since inception	Last 10 years	Last 5 years
Asset classes					
Equity	Jan 1999	Dec 2018	0.34	0.25	-0.04
Fixed-income	Jan 1998	Dec 2018	0.11	0.82	-0.10
Management entities					
Equity	Jan 1999	Dec 2018	0.35	0.25	-0.03
Fixed-income	Jan 1998	Dec 2018	0.11	0.82	-0.11
Fund	Jan 1998	Dec 2018	0.19	0.50	-0.02

NBIM relative returns

Chart 13 Annual relative return on the fund's asset management. Percentage points



Sharpe ratio, NBIM

Sharpe ratio after management costs for various sample sizes: management entities

Annualised Sharpe ratio estimates after costs for various sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and total portfolios and corresponding benchmarks.

	Management entity	Since inception	Last 10 years	Last 5 years
Portfolio	Equity	0.31 (-0.13, 0.75)	0.82 (0.19, 1.45)	0.54 (-0.34, 1.42)
	Fixed income	0.79 (0.36, 1.22)	1.37 (0.72, 2.01)	0.98 (0.08, 1.87)
	Fund	0.49 (0.06, 0.92)	1.01 (0.38, 1.64)	0.65 (-0.23, 1.54)
Benchmark	Equity	0.29 (-0.15, 0.73)	0.81 (0.18, 1.44)	0.55 (-0.33, 1.43)
	Fixed income	0.79 (0.36, 1.23)	1.16 (0.52, 1.79)	0.94 (0.05, 1.84)
	Fund	0.49 (0.06, 0.92)	0.98 (0.35, 1.61)	0.66 (-0.22, 1.55)

Information ratio, NBIM

Information ratio before management costs for various sample sizes: asset classes

Annualised information ratio estimates before costs for various sample periods, along with 95 percent confidence intervals (parentheses). The estimates are based on monthly returns of equity, fixed-income and total portfolios and corresponding benchmarks.

Asset class	Since inception	Last 10 years	Last 5 years
Equity	0.61	0.75	0.06
	(0.16, 1.05)	(0.13, 1.38)	(-0.82, 0.94)
Fixed income	0.14	0.81	-0.16
	(-0.29, 0.57)	(0.18, 1.44)	(-1.04, 0.72)
Fund	0.39	1.00	0.11
	(-0.04, 0.82)	(0.37, 1.63)	(-0.77, 0.98)

Risk adjusted returns on equity, NBIM

	Since 1999 (1)	Last 10 years (2)	Last 5 years (3)
Alpha	0.20	0.15	−0.08
	(1.15)	(0.94)	(−0.33)
F-F MKT	0.02	0.01	0.01
	(4.62)	(4.04)	(3.91)
F-F SMB	0.05	0.03	0.03
	(7.09)	(3.91)	(3.12)
F-F HML	−0.01	0.00	0.02
	(−1.35)	(0.01)	(2.72)
F-F RMW	0.01	−0.02	0.00
	(1.09)	(−1.58)	(0.28)
F-F CMA	−0.02	−0.02	−0.04
	(−2.06)	(−2.33)	(−2.54)
Observations	240	120	60
Adjusted R^2	0.44	0.37	0.30

Risk adjusted returns on FUND, NBIM

	Since 1998 (1)	Last 10 years (2)	Last 5 years (3)
Alpha	−0.00	0.19	0.06
	(−0.01)	(1.38)	(0.44)
F-F MKT	0.02	0.02	0.01
	(5.26)	(5.15)	(2.73)
F-F SMB	0.03	0.04	0.03
	(6.96)	(4.24)	(3.69)
F-F HML	0.01	0.02	0.01
	(1.64)	(3.45)	(1.44)
F-F RMW	0.02	0.03	0.02
	(2.64)	(2.59)	(1.32)
F-F CMA	−0.03	−0.01	0.00
	(−2.69)	(−1.46)	(0.03)
DEF Adj	0.03	0.01	0.00
	(2.76)	(1.30)	(0.16)
TERM	−0.01	−0.02	−0.03
	(−1.79)	(−2.37)	(−4.08)
Observations	252	120	60
Adjusted R^2	0.52	0.49	0.37