ECON4510 Finance Theory, Lecture 11

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
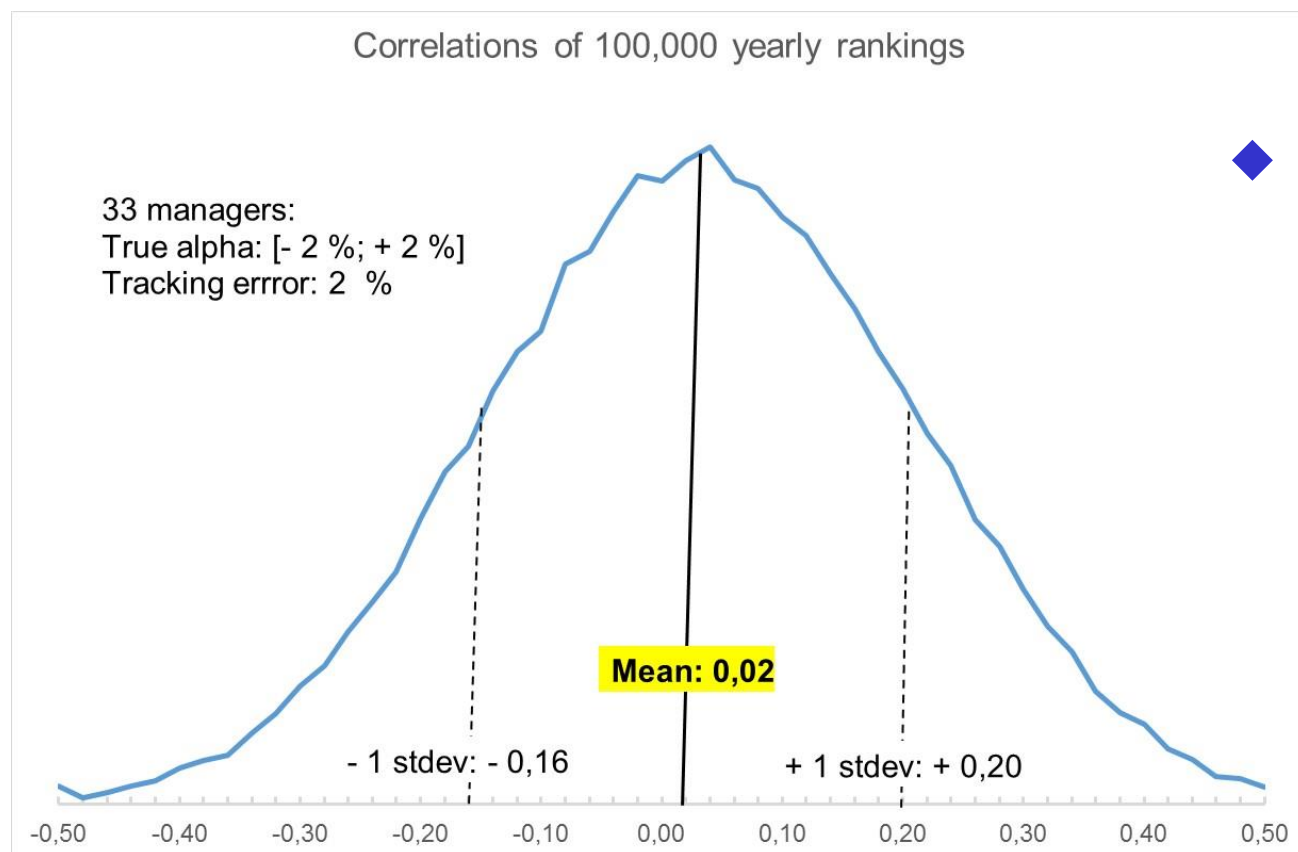
◆ Average of 28 pairwise correlations = 0.01

Årsammenlignet		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 **DN** grafikk/Kilde: Prof. Ola Kvaløy/Oslo Børs VPS

◆ 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 (?)

DN, 15 April 2015

«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

Correlations of 100,000 yearly rankings

33 managers:
True alpha: [- 2 %; + 2 %]
Tracking errror: 2 %

Mean: 0,02

- 1 stdev: - 0,16   + 1 stdev: + 0,20

-0,50   -0,40   -0,30   -0,20   -0,10   0,00   0,10   0,20   0,30   0,40   0,50

◆ 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
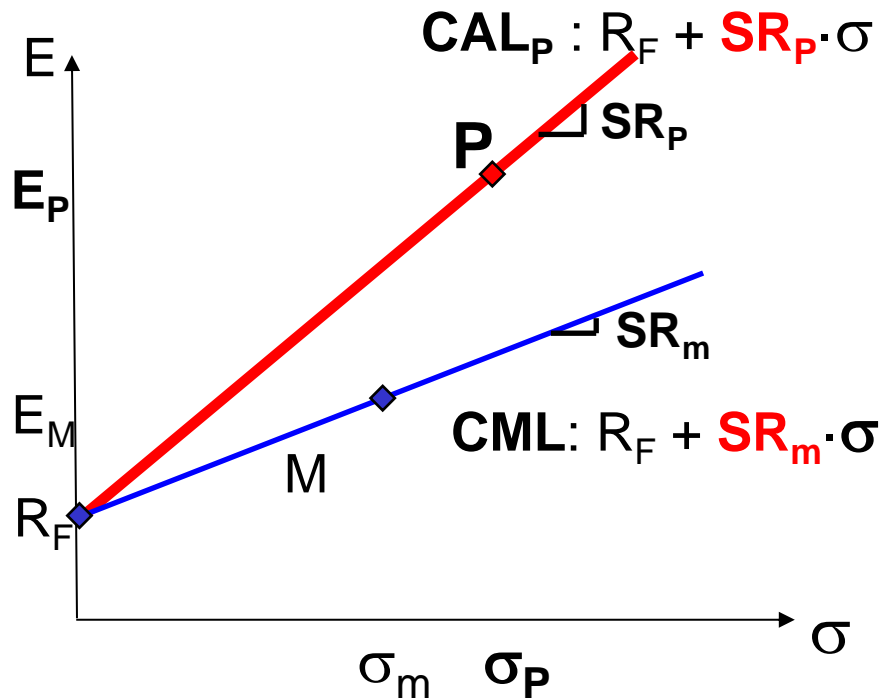
Risk adjusted performance measures

◆ 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
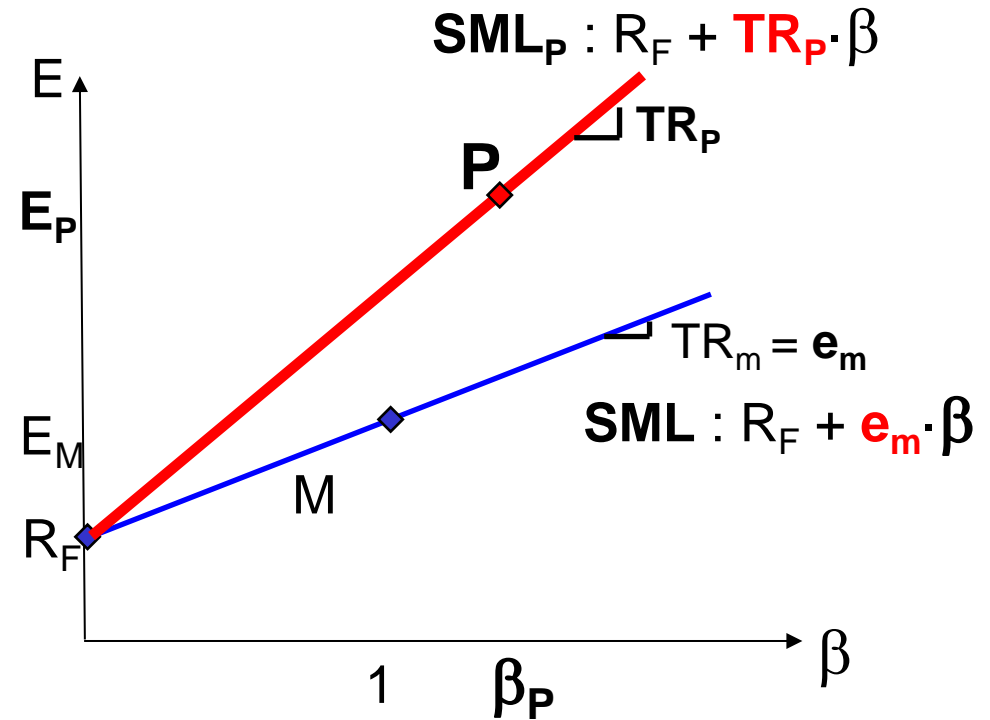
◆ Macro level
◆ Max SR $\Leftrightarrow$ M-V preferences

◆ Micro level; diversified owner
◆ Max TR $\Leftrightarrow$ CAPM

Sharpe

$CAL_P : R_F + SR_P \cdot \sigma$

SR_P

P

E_P

SR_m

E_M

$CML: R_F + SR_m \cdot \sigma$

M

R_F

σ_m σ_P σ

◆ "Reward to variability":
$$SR = e / \sigma$$

Treynor

$SML_P : R_F + TR_P \cdot \beta$

TR_P

P

E_P

$TR_m = e_m$

E_M

$SML : R_F + e_m \cdot \beta$

M

R_F

1 β_P β

◆ "Reward to β-variability":
$$TR = e / \beta$$

Performance measure 2: Risk Adjusted Performance
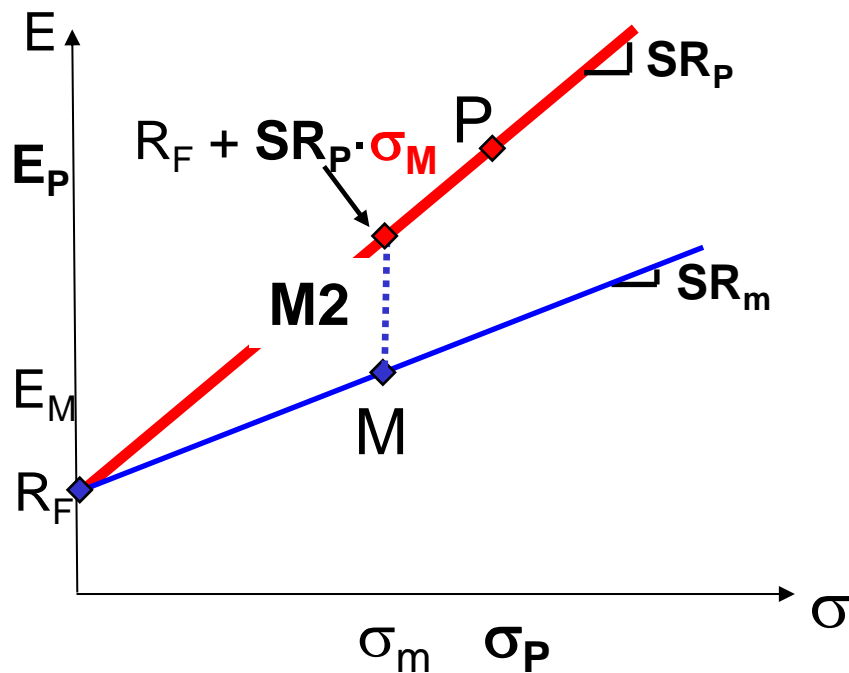
M2
(rel. σ_M)

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

- ◆ M2 $= e_P \cdot (\sigma_m / \sigma_P) - e_m$
   $= [SR_P - SR_m] \cdot \sigma_m$
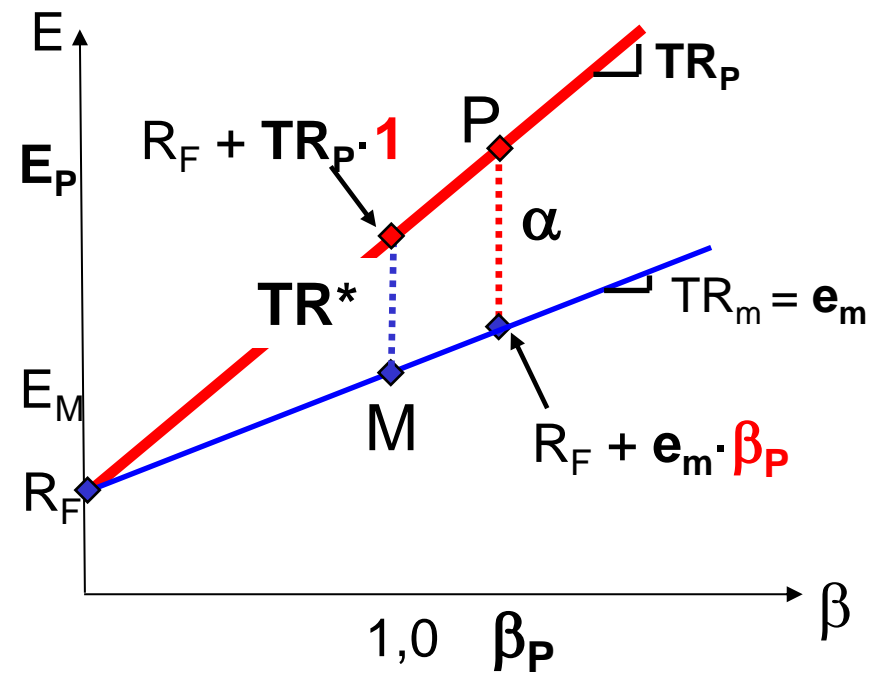
- ◆ TR* $= e_P / \beta_P - e_m$
   $= [TR_P - e_m] \cdot 1{,}0$

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

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Perfomance measure 3: IR and AR

◆ <u>Information rate (IR)</u> scales active excess return by active risk; '**tracking error**'

   (both measured ralative to benchmark portfolio)

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

◆ <u>Appraisal Ratio (AR)</u> 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

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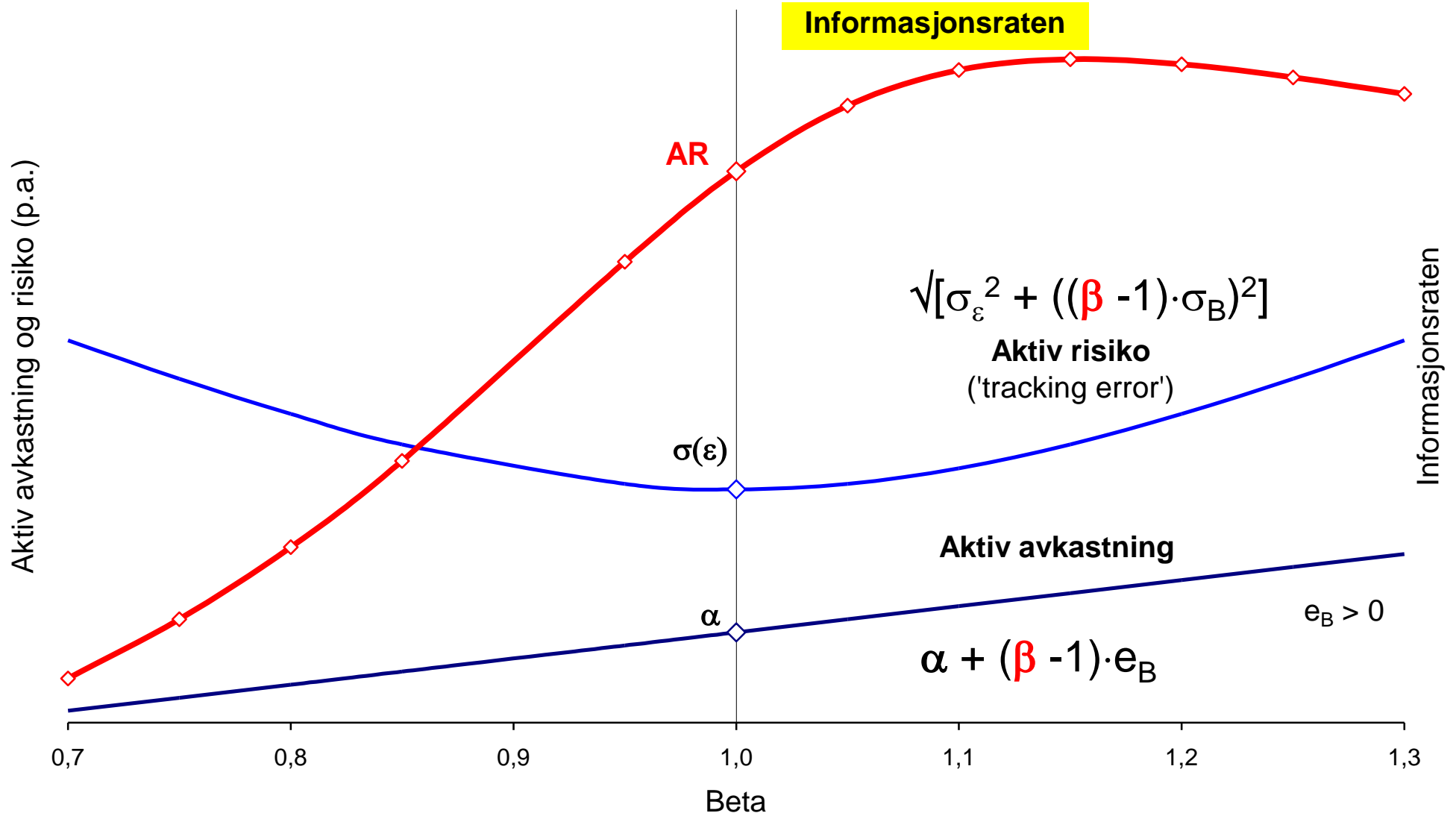
◆ Only alpha-bets $(\beta_P = \beta_B)$

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

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

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

Beta factor in IR

Aktiv avkastning og risiko (p.a.)

Informasjonsraten

AR

$$\sqrt{[\sigma_\varepsilon^2 + ((\beta - 1) \cdot \sigma_B)^2]}$$

Aktiv risiko
('tracking error')

$\sigma(\varepsilon)$

Aktiv avkastning

α

$e_B > 0$

$$\alpha + (\beta - 1) \cdot e_B$$

| 0,7 | 0,8 | 0,9 | 1,0 | 1,1 | 1,2 | 1,3 |

Beta

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Sharpe - Alpha - Treynor - Appraisal - IR

◆ <u>SR / TR / IR</u>: owner gears excess return by borrowing/lending at R_f

⇒   <u>Alpha</u>: sign is most interesting (on its own)

◆ <u>SR / IR</u>: macro level

◆ <u>Treynor / Alpha / IR / AR</u>: micro level (subportfolios)

– <u>Treynor/Alpha</u>: total portfolio is diversified

– <u>IR / AR</u>: 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

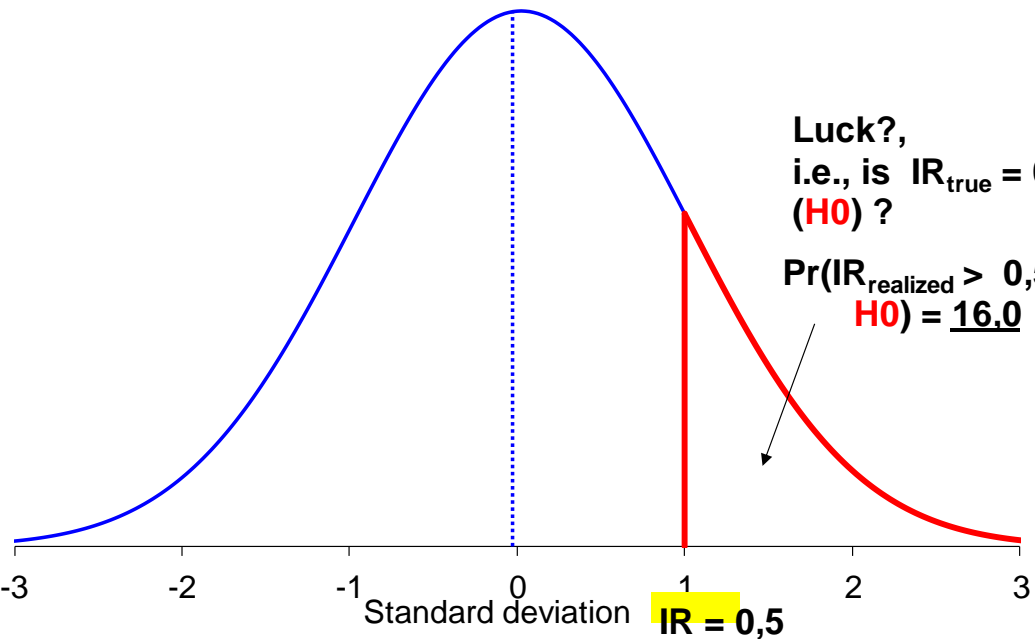# Is manager skilled? $E(R - R_B) = \mathbf{E(r) > 0}$?

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

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

Luck or skill

Example: $\mathbf{IR = 0{,}5}$ and $\mathbf{n = 4}$

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

Luck?, i.e., is $IR_{true = 0}$ (H0) ?

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

$Pr(IR_{realized} > 0{,}50 /$ H0$) = \underline{16{,}0}$
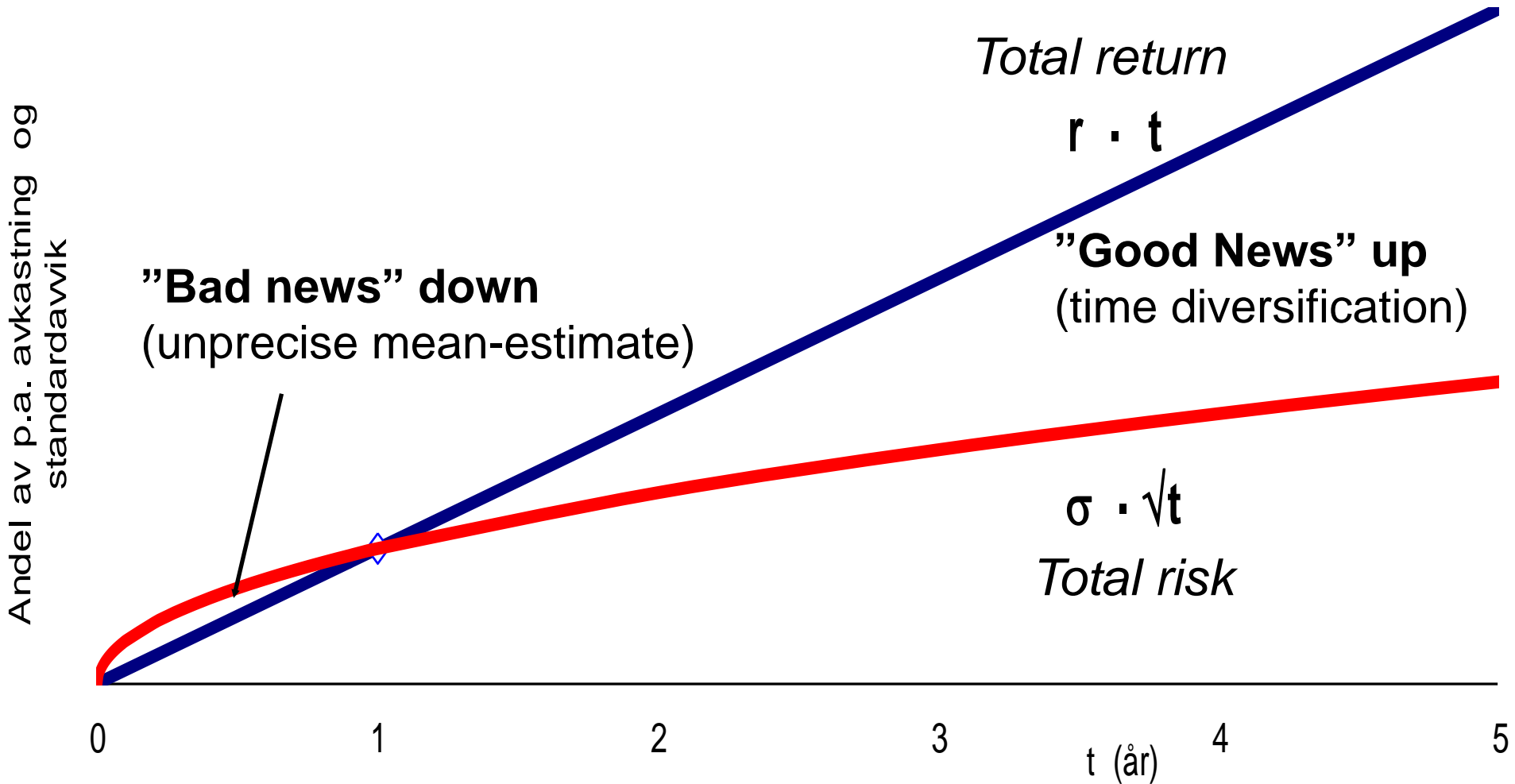
$\cong 50\% - t \cdot \mathbf{34\%} = \underline{\mathbf{16\%}}$

Using normal distribution, since precicely estimated std.dev

-3   -2   -1   0   1   2   3
Standard deviation   IR = 0,5

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

Total return

r · t

"Good News" up
(time diversification)

"Bad news" down
(unprecise mean-estimate)

σ · √t

Total risk

Andel av p.a. avkastning og standardavvik

0   1   2   3   4   5

t (år)

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

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How many observations do we need for precision?

#obs	Quarter	Year	
	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		

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

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

$$= \frac{IR_{\mathring{a}r}}{\sqrt{4}} \cdot \sqrt{4 \cdot \#\mathring{a}r} = \mathbf{T_{\mathring{a}r}}$$

Attribution analysis

Tabell 27 Bidrag fra investeringsstrategiene til aksje- og renteinvesteringenes relative avkastning fra 2013 til 2016. Annualisert. Prosentpoeng

	Aksje-investeringer	Rente-investeringer	Allokering på tvers av aktivaklasser	Totalt
Allokering	-0,03	-0,14	0,04	-0,13
Intern referanseportefølje	-0,01	-0,14	0,00	-0,15
hvorav systematiske faktorer	0,02			0,02
hvorav utvidelse av investeringsuniverset	0,00	-0,09		-0,09
Allokeringsbeslutninger	-0,02	0,00	0,04	0,02
Verdipapirseleksjon	0,07	0,00		0,07
Internt	-0,02	0,00		-0,02
Eksternt	0,09			0,09
Markedseksponering	0,17	0,08	0,00	0,25
Posisjonering	0,12	0,08	0,00	0,20
Utlån av verdipapirer	0,05	0,00		0,06
Totalt	0,21	-0,06	0,04	0,20