1. Risk Management System. Goals Exposure

List of topics

No	Lecture
1	Risk Management System. Goals. Exposure
2	Measuring Risk. Traditional Measures. Value at Risk. EaR. CFaR. Hedging and Speculation
3	INTEREST RATE RISK. Term Structure of Interest Rates. Conversions
4	Spot and Forward Interest Rates. Bootstrapping
5	Interest Rate Exposure. Stochastic Methods
6	Interest Rate Gap. Duration
7	CURRENCY RISK. Spot and Forward Foreign Exchange Rates. Theories
8	Currency Exposure. Value at Risk
9	Currency Strategies. Performance Attribution
10	CREDIT RISK. Ratings. Default Probabilities. Recovery Rates
11	Credit Exposure. Simulation Methods. Structural and Reduced-Form Models
12	Credit Risk Management Systems (CreditRisk+, KMV and EDF, CreditMetrics, Credit Portfolio View)
13	OPERATIONAL RISK. Integrated Systems. Actual Problems

Literature

A. Saunders, Financial Institutions Management. Irwin. 1994.
R.G.Clarke, M.P.Kritzman, Currrency Management, Concepts and Practices, 1996

Risk Management System

Goals	Risk factors	Exposure	Measures	Management
1. absolutne value earnings cash flows	1. market risk - volatility a. price b. interest rate c. exchange rate	1. valuation methods a. traditional b. non-arbitrage c. binomial d. simulation	1. traditional methods variance standard deviation	1. management strategies conservative active (optimization) (captal allocation)
2. relative simple rate of return logarithmic rate of return	2. credit risk creditworthiness changes a. cash flows adjustments credit scoring default probabilities recovery rates b. interest rate adjustments risk premium migration analysis		2. concentration and diversification measures	2. limits
	3. operational risk		3. sensitivity measures currency gap interest rate (duration) gap options δ, γ, τ, ρ, κ	3. capital adequacy regulatory capital economic capital
			4. modern methods VaR EaR CFaR	4. performance measurement ΔV/VaR P&L/EaR ΔCFAT/CFaR
			5. Stress test	

Goals

(1) $$PV = \sum_{t=1}^{n} \frac{CF_t}{(1+RRR)^t} + \frac{CV_n}{(1+RRR)^n}$$

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

(2) $$= \frac{P_t}{P_{t-1}} - 1$$

$$= \frac{\Delta P_t}{P_{t-1}}$$

(3) $$1 + R_t = \frac{P_t}{P_{t-1}}$$

$$r_t = \ln(1+R_t) = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

(4) $$= \ln(P_t) - \ln(P_{t-1})$$

$$= p_t - p_{t-1}$$

Risk factors

- *price risk*
- *interest rate risk*
- *foreign exchange rate risk*)
- *market risk*
- *credit risk*
- *liquidity risk*
- *capital risk*
- *country/sovereign risk*
- *off-balance-sheet risk*
- *business risk*
- *operational risk*
- *technology risk*
- *marketability risk*
- *environment*
- *war, revolution*

Exposure

Methods:

- sensitivity analysis,
- scenario analysis,
- probabilistic (decision trees),
- analytical,
- simulation.

Analytical Methods

Taylor expansion:

(5) $$f(x) = \frac{f(x_0)}{0!} + \frac{f'(x_0)}{1!}(x - x_0) + \frac{f''(x_0)}{2!}(x - x_0)^2 + \ldots + \frac{f^n(x_0)}{n!}(x - x_0)^n + R_n$$

(6) $$\Delta W \cong + \delta \Delta x$$

(7) $$\Delta W \cong + \delta \Delta x + \frac{1}{2}\gamma \Delta x^2$$

$\Delta W = f(x) - f(x_0)$ – change in value

$\Delta x = x - x_0$ change in risk

EVA for equityholders

(8) $EVA_E = NI - R_E \times E_P$

or

(9) $EVA_E = (ROE - R_E) \times E_P$

where

NI – net income,

R_E - cost of equity,

E_P – equity at the beginning of period,

ROE - NI/E_P.

EVA for the firm

(10) $EVA_F = NOI\ (1-T) - R_{EA} \times (E_P+D_P)$

or

(11) $EVA_F = (ROA - R_A) \times (E_P+D_P)$

where

NOI (1-T)– net operating income after tax,

R_A - weighted average cost of capital,

(E_P+D_P) – equity + debt,

ROA – $NOI(1-T)/ (E_P+D_P)$

Realized alfa (ex post alfa)

(12) $R_t = R_{Pt} - R_{Bt} = \alpha + \xi_t$

(13) $\alpha_R \equiv \overline{R} = \frac{1}{n}\sum_{t=1}^{n} R_t$

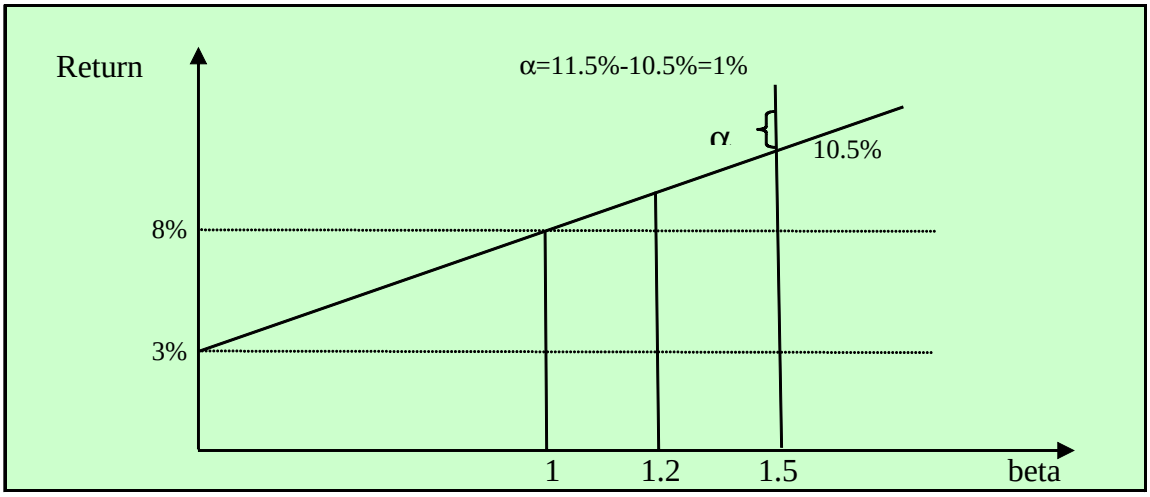
Realized omega (tracking error)

(14) $\omega = \sigma_R = \sqrt{\frac{1}{n-1}\sum_{t=1}^{n}\left(R_t - \overline{R}\right)^2}$

(15) $\omega = \sigma_R = \sqrt{Var(\xi_t)}$

Information ratio)

(16) $IR = \frac{\alpha}{\omega}$



Problem 1

After 73 days the price of a stock rose from PLN 100 do PLN 102.

1. Calculate simple rate of return ?
2. What is the annualized rate of return ?
3. What is the annualized return if the new price level is reached after 4 years ?

Solution

Ad 1.

Return is equal to: (102 : 100) -1 = 2%

Ad 2.

The annualized return is: (1 + 2,0%)^(365:73) -1 = 10,41%.

Ad 3.

The annualized return is equal to: (1 + 2,0%)^(365:1460) -1 = 0,50%.

Problem 2

Consider an investment with the following data

Period	*Value*
1	100
2	120
3	96
4	105,6
5	95,04

1. Calculate simple returns for each period.
2. Calculate arithmetic mean for the whole period.
3. Calculate geometric mean for the whole investment period.

Solution

Ad 1.

Period	Return	Gross return
2	20%	120%
3	-20%	80%
4	10%	110%
5	-10%	90%

Ad 2.

Arithmetic mean is equal to 0%.

Ad 3.

Geometric mean is equal to:

(120,0% * 80,0% * 110,0% * 90,0%) ^(1/4) - 1 = -1,3%.

Problem 3

Begining (t=0) and ending (t=1) values of a portfolio which consists of three items are following:

	Value	
Investment	t=0	t=1
1	100	110
2	400	350
3	500	680
	1000	1140

1. Calculate simple returns for each investment and the whole portfolio.
2. Calculate continuously compounded returns for each investment and the whole portfolio.

Solution

Ad 1.

Return for the whole portfolio is: (1140 : 1000) - 1 = 14,0%.

This return may be also calculated as an average of simple returns for each item.

The weights are calculated for the moment t=0.

	Value				
Investment	t=0	t=1	w	R	w * R
1	100	110	0,1	10%	1%
2	400	350	0,4	-12,5%	-5%
3	500	680	0,5	36%	18%
	1000	1140			14%

Ad 2.

Logarithmic return for the whole portfolio is equal to: ln(1140:1000) = 13,1%.

This return may be also calculated using log returns for each portfolio using the formula:

$$r_p = \ln\left(\frac{P_1}{P_0}\right) = \ln\left(w_1 e^{r_1} + w_2 e^{r_2} + \cdots + w_n e^{r_n}\right)$$

Investment	1+R	r	w	e^r =1+R	w * e^r
1	110,00%	9,5%	0,1	1,100	11%
2	87,50%	-13,4%	0,4	0,875	35%
3	136,00%	30,7%	0,5	1,360	68%
				Σ	114%
				r_p =	13,1%