

Practical Examples of Financial Modelling

André van Vliet

Lunteren Conference, 20 januari 2005

ORTEC
Postbus 4074
3006 AB Rotterdam
Max Euwelaan 78
Tel. +31 (0)10 498 6666
info@ortec.com
www.ortec.com

Outline

- ORTEC
- Part I : OPAL Asset Planner
- Part II : Index Tracking
- Part III : ALM for Housing Corporations.

Business Description

ORTEC is a privately held company that provides optimization and simulation based decision support software, and professional consulting services to clients across a wide variety of industries, including:

- Asset & Liability Management
- Performance & Risk Management
- Transport & Logistics
- Workforce Management
- Production Planning

Office Locations:

Netherlands : Gouda, Rotterdam, Amsterdam, Groningen

Other countries : Belgium, France, Germany, Singapore, South-Africa, USA

Founded: April 1981

Number of Employees: 375

Clients: Blue-chip customer base that includes leading enterprises in industry, banking, insurance and logistics :

..., ABN-AMRO, Airbus Industries, AKZO Nobel, AP-funds, BNP Paribas, Belgacom, BASF, Bank of International Settlements, BP Amoco, CERN, Coca Cola, Contrassur, Danzas, HSBC, Exxon Mobil, Fortis, Hapag Lloyd, IBM, ING, KLM, Maersk, Philips, Rabobank, Shell, Statoil, SONY, TNT, The World Bank, Yellow Freight System, ...

- Services:
1. Customized Decision Support Systems
 2. Professional Consulting Services
 3. Standard Software Products
 4. Training Courses



Business Activities :

- ALM for Pension funds
- ALM for Housing Corporations
- ALM for Insurance Companies
- ALM for Banks
- Performance evaluation + attributions
- Financial Planning (OPAL)
- Private Loans + Mortgages
- Index Tracking
- Valuation of real-estate (Aedex / OrtaX)
- Risk Analysis + Risk Budgeting
- Projects ...

Part I : OPAL Asset Planner

Optimized

Personal

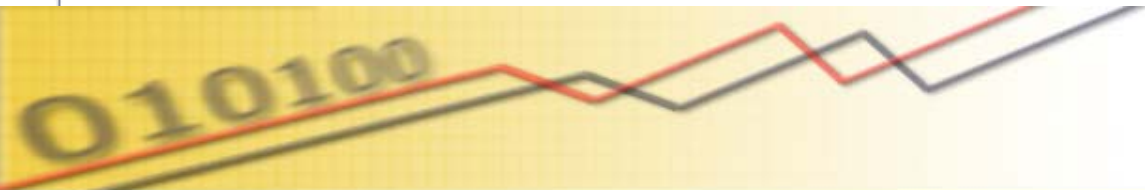
Asset

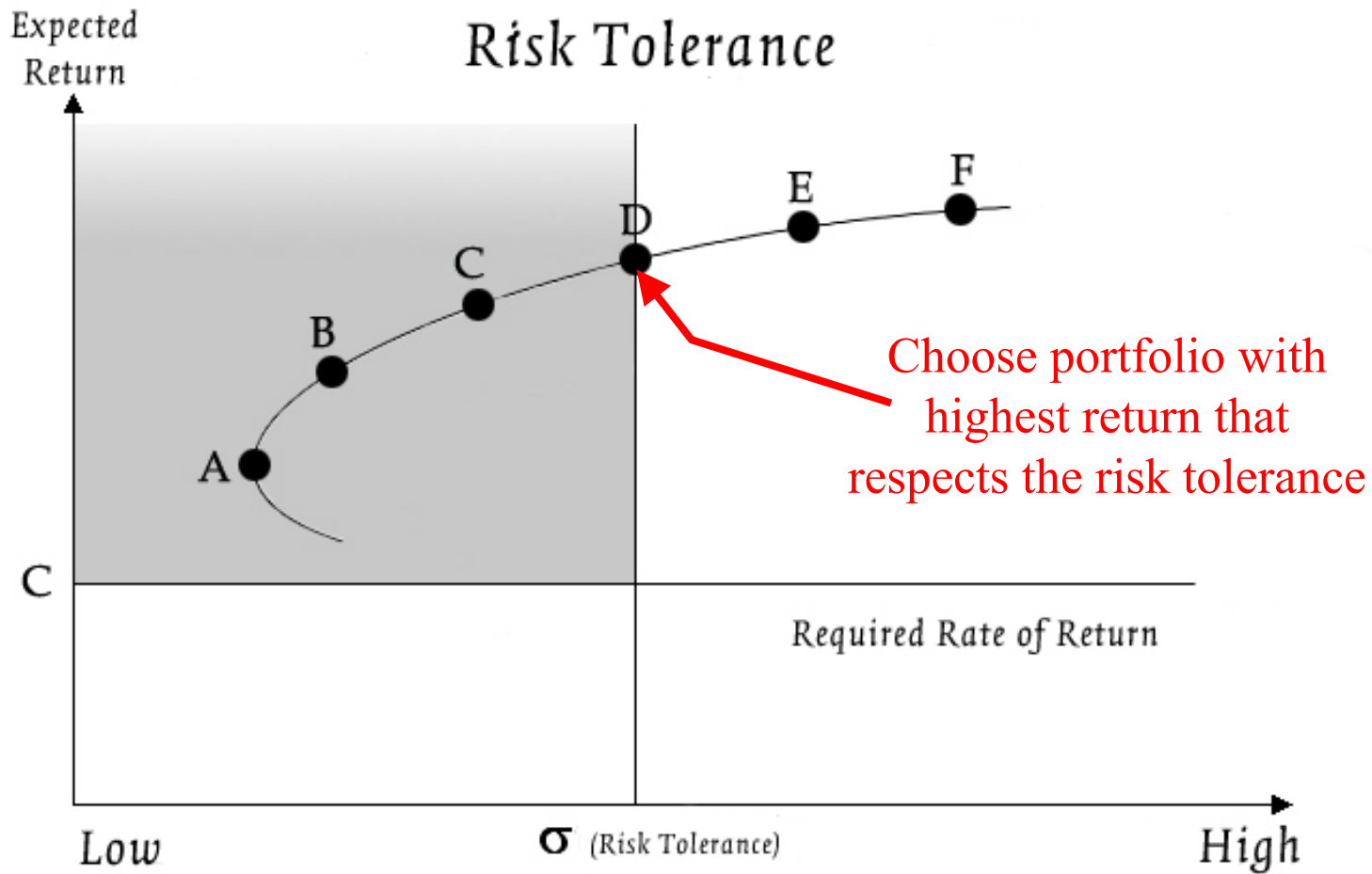
Liability



**ALM for
individuals**

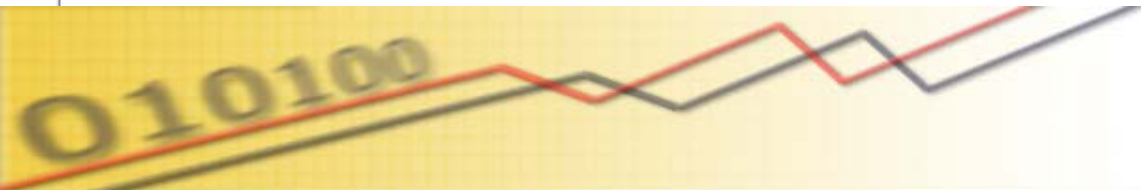
**Asset Allocation Software based on
enhanced Scenario Techniques**

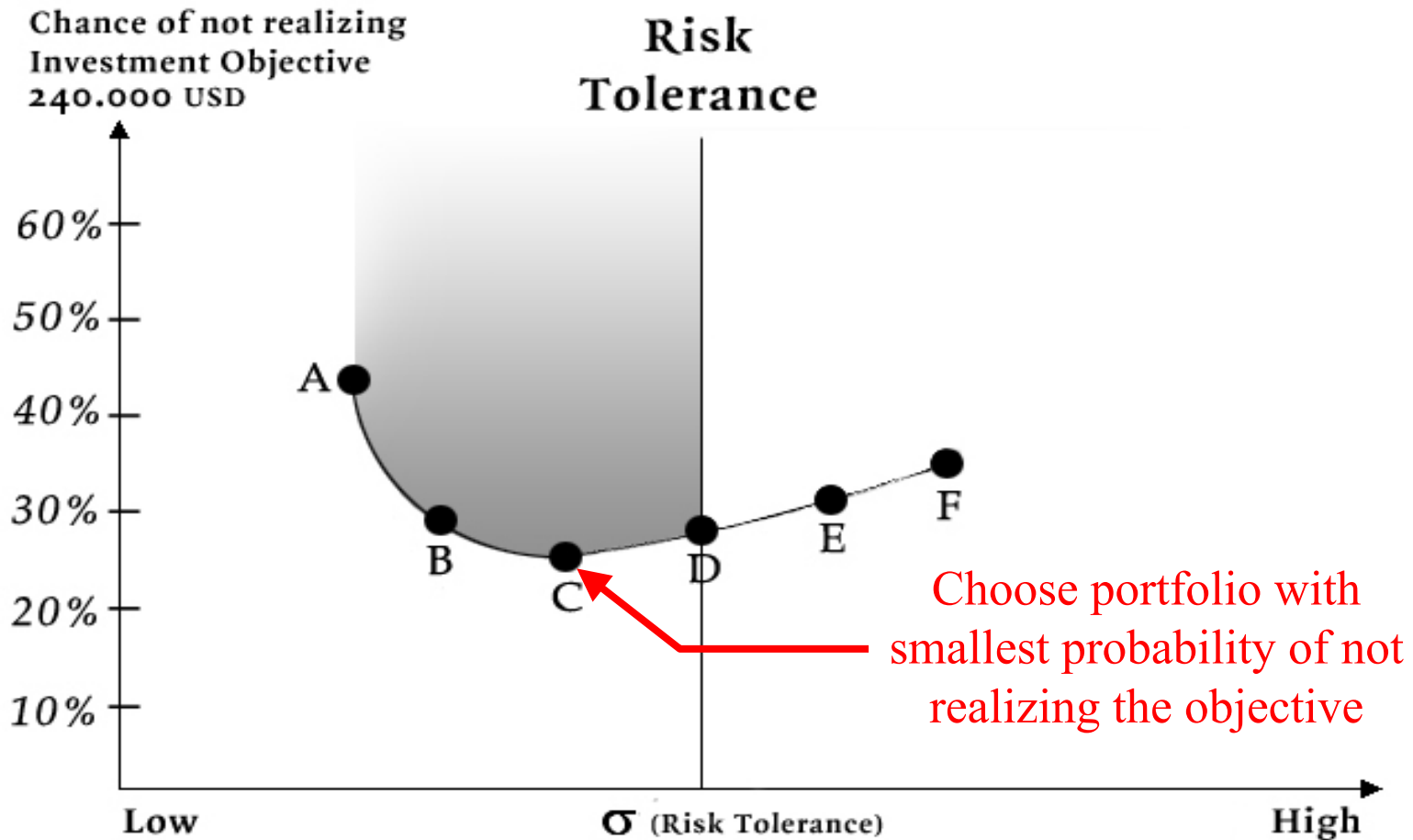




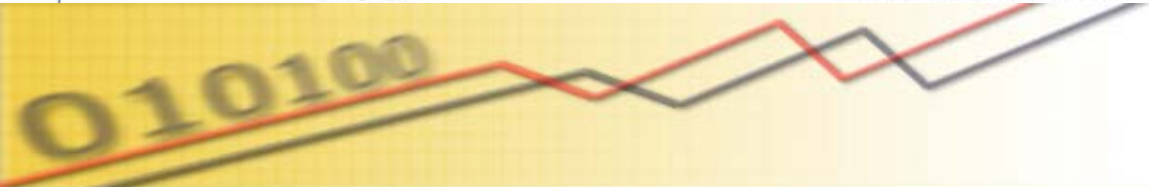
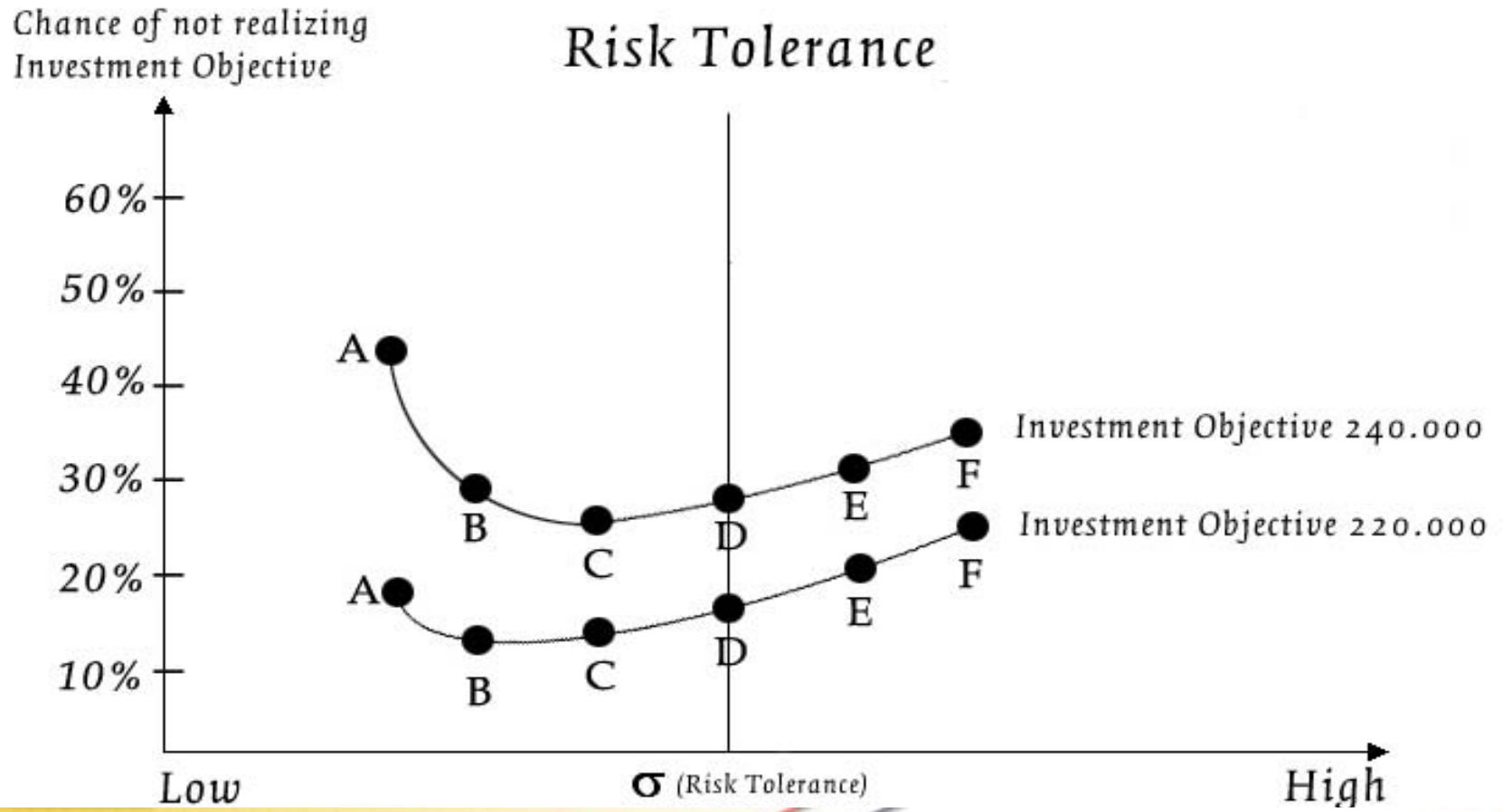
Our definitions of risk :

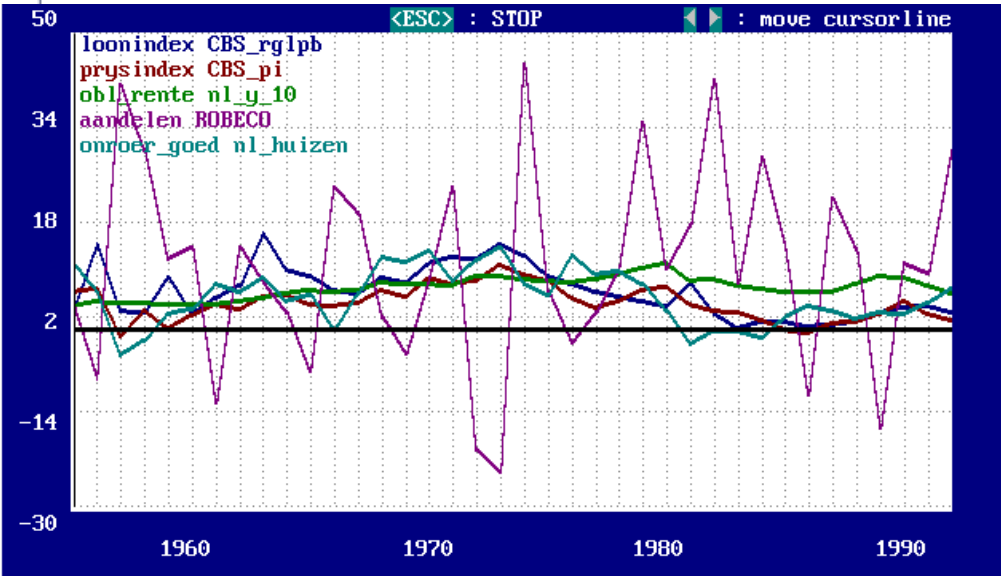
- Standard deviation of an investment
(Risk Tolerance)
- **Chance of NOT obtaining the investment objectives !!**
- Value at Risk





OPAL Asset Planner - Lower objective



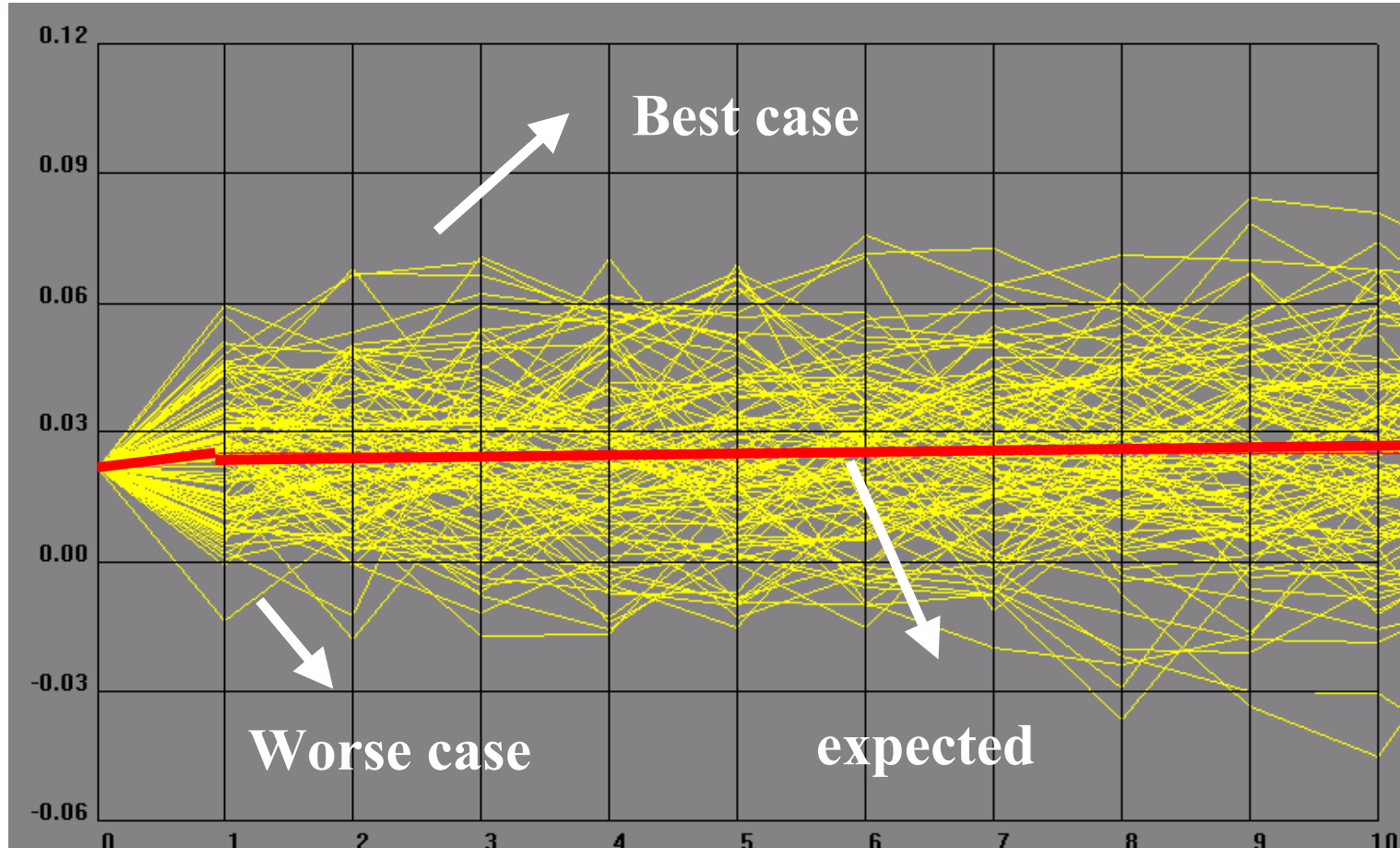


statistics from
historical period:

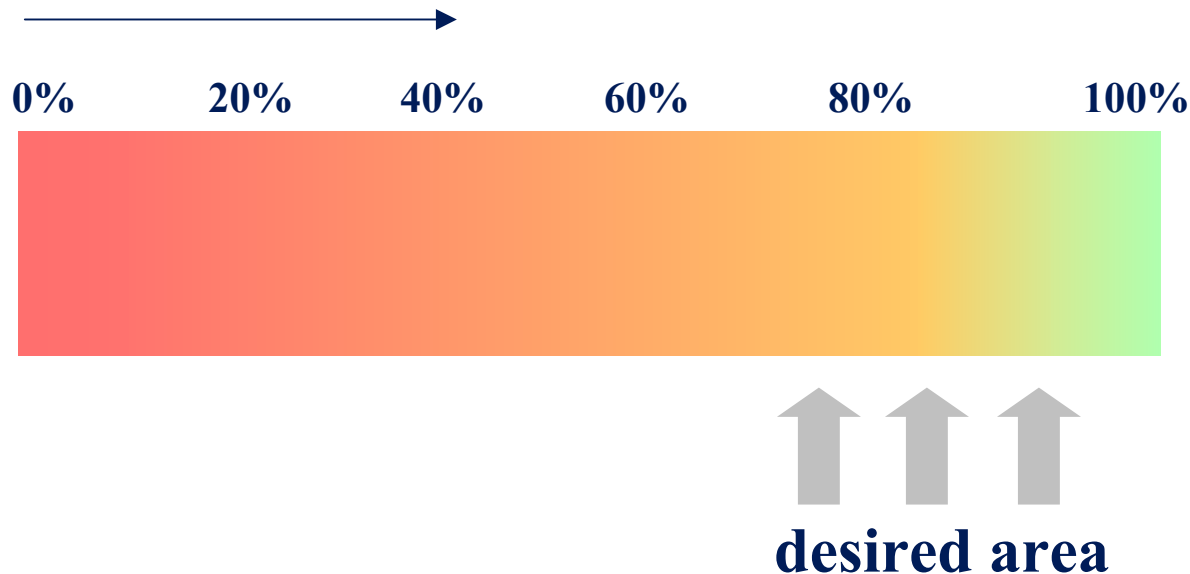
- **standard deviations**
- **(auto-) correlations**
- **averages: economic outlook**

GENERATING SCENARIOS:

set with price inflation, (total) returns on equities and fixed income, and **preserving of characteristics**



- Applying scenarios to calculate the risk of not realizing *the investment objectives*
- Probability of realizing goals :



Initial investments

Total assets of 800.000

Financial objectives

1. An inflation adjusted **income** of 34.000 a year
2. Preserve **wealth** for at least 20 years



Goal : **INCOME**

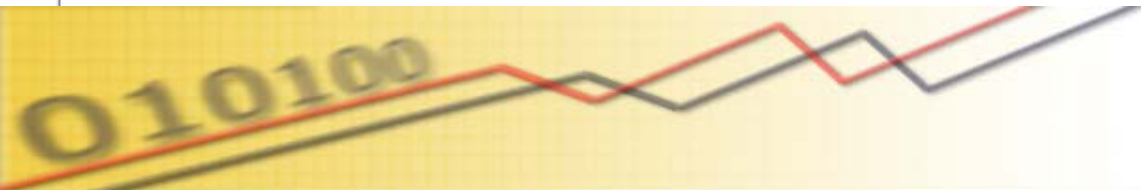
Stocks	Bonds	Expected value
%		
0	100	440.000
20	80	604.000
40	60	779.000
60	40	971.000
80	20	1.174.000
100	0	1.380.000

What is your advice?



Goal : **INCOME**

Stocks %	Bonds	Expected value	Chance of NOT reaching goal	Years realizing income
0	100	440.000	0,0%	20
20	80	604.000	0,2%	20
40	60	779.000	2,8%	20
60	40	971.000	10,4%	17
80	20	1.174.000	17,0%	14
100	0	1.380.000	23,6%	12



Goal : **INCOME & WHEALTH**

Stocks %	Bonds	Expected value	Chances of not realizing		Years realizing income
			Income	Wealth	
0	100	440,000	0.0%	99.8%	20
20	80	604,000	0.2%	79.4%	20
40	60	779,000	2.8%	56.6%	20
60	40	971,000	10.4%	49.8%	17
80	20	1,174,000	17.0%	49.4%	14
100	0	1,380,000	23.6%	50.6%	12

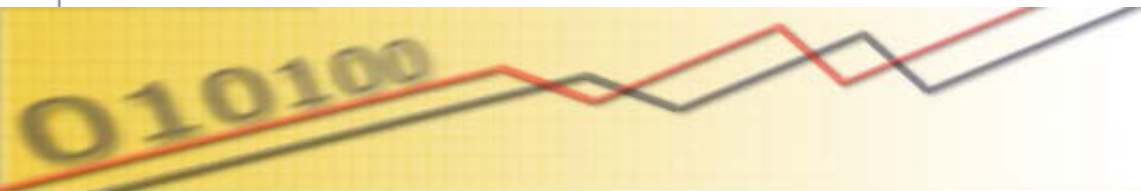
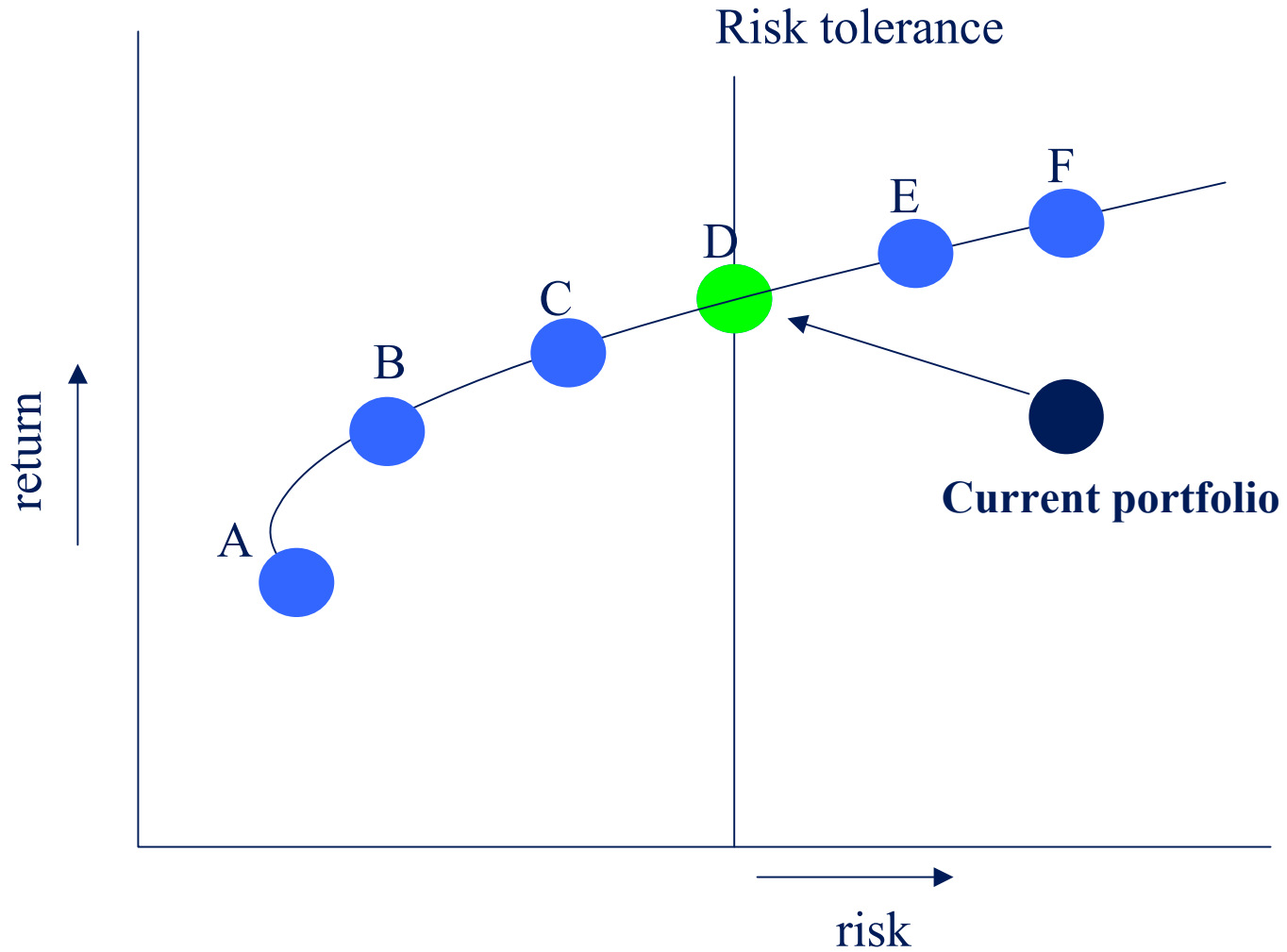
Optimization (less risk/higher returns) of asset allocation from a risk/reward perspective with various risk measures

Example:

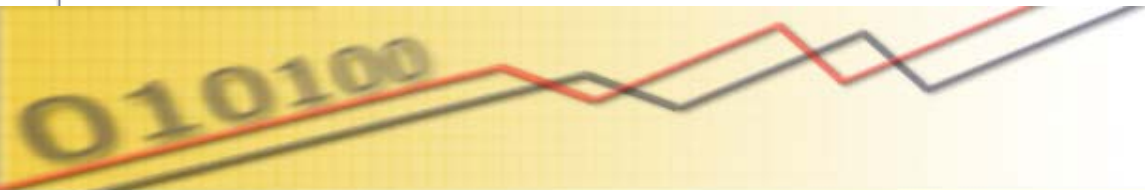
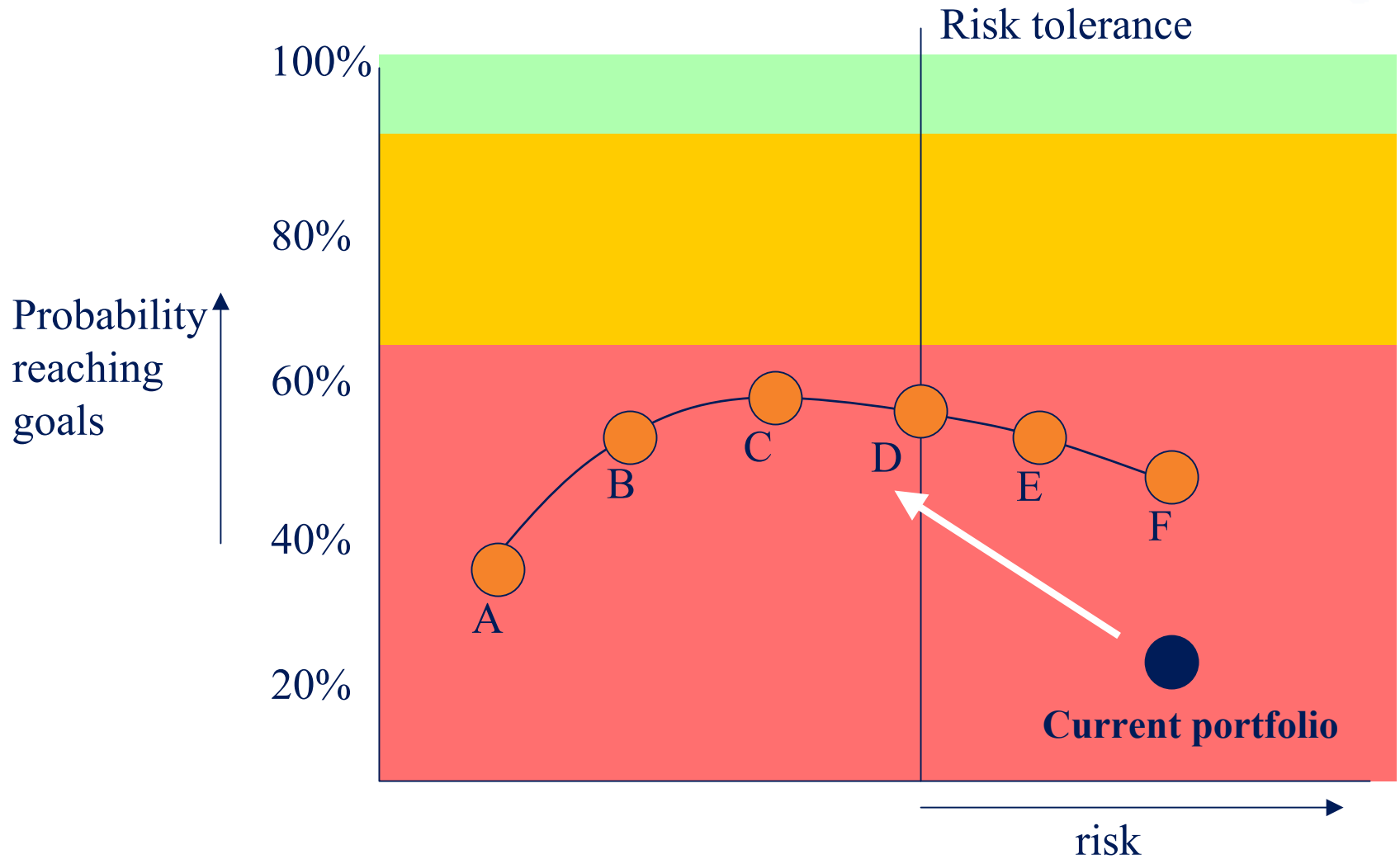
College saving plan



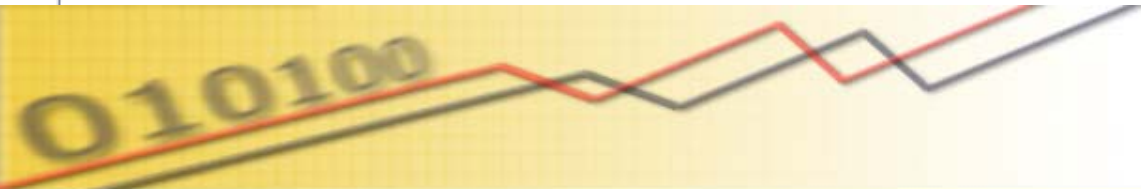
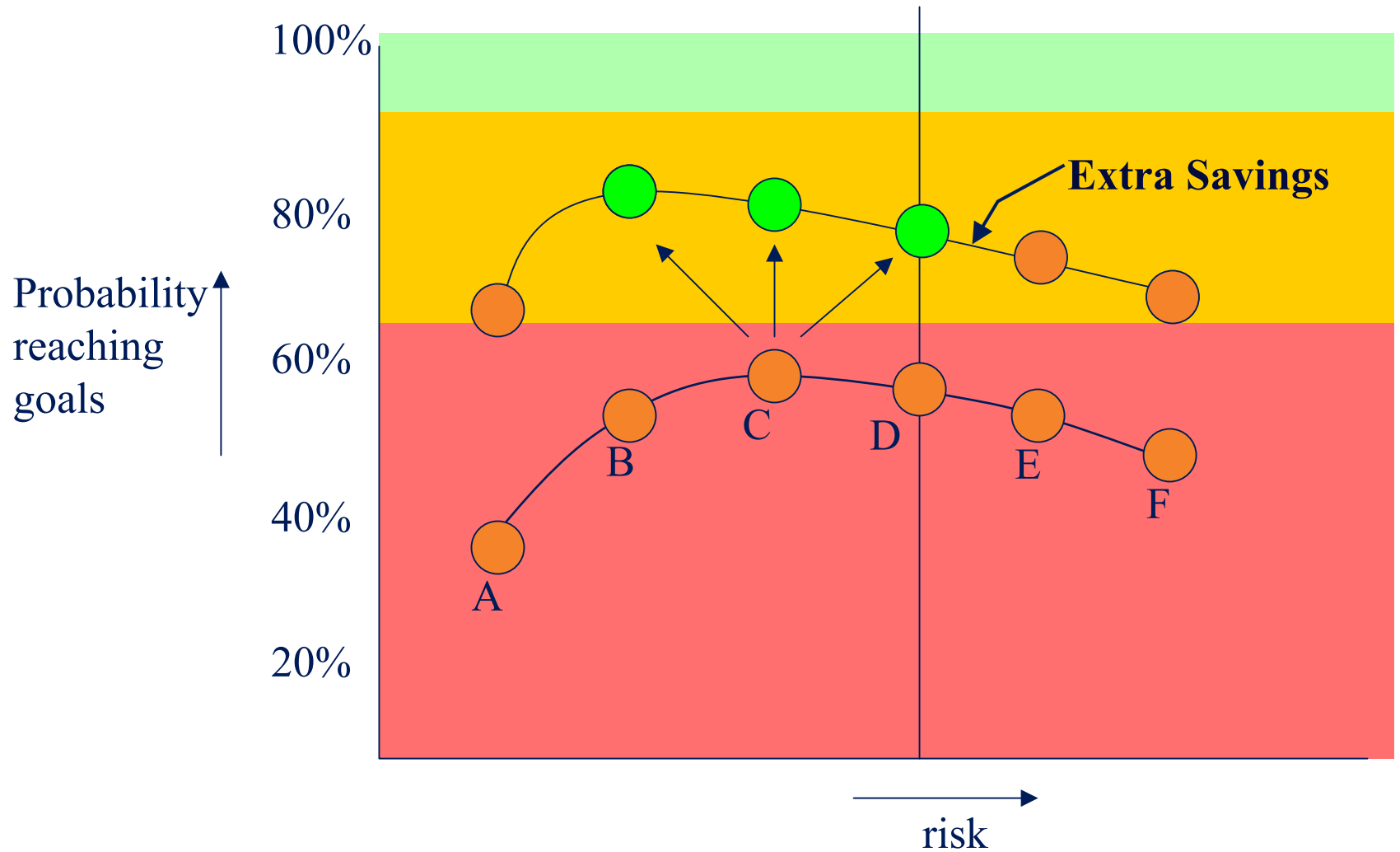
OPAL : Case 2 - College Saving Plan




OPAL : Case 2 - College Saving Plan



OPAL : Case 2 - College Saving Plan



Dryden



Financial

Personal Data

Risk Tolerance

Investments

Allocation strategy








Objectives

Asset Allocation

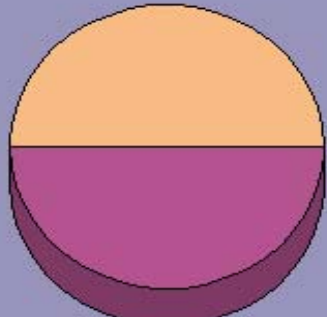
Indicate whether you would like to use the corporate portfolios or create a custom portfolio. Enter the percentage or amount you would like to invest in each asset class for the custom portfolio. You can compare the custom portfolio to the corporate portfolios.

Use corporate portfolios Create a custom portfolio

Name Portfolio:

Color	Description	%	€
	Equity	50	500
	Fixed Income	50	500
	Real estate	0	0
	Cash	0	0
	Hedge Dis. Sec.	0	0
	Hedge Event	0	0
	Hedge FoF	0	0

Compare to corporate portfolios



Income extra Def

Allocation | Rebalance Strategies | Fixed Return Category

Start

Part II: Index Tracking

Index Tracking - Motivation

1. Settle for an average (market) return
2. While minimizing all costs
 - Explicit transactions costs : brokerfees + taxes
 - Implicit transaction costs : bid-ask spreads
 - Management fees

*“ABN Amro verhoogt tarieven fondsbeheer”,
De Financieele Telegraaf, 29-09-2004*

“AMSTERDAM (DFT) - ABN Amro verhoogt per 1 januari de beheerskosten van zijn beleggingsfondsen. De jaarlijkse vergoeding van de meeste fondsen gaat van 1,2% naar 1,35%”

Objective :

- Minimize the tracking error, this is the quadratic sum of excess returns.

(excess return = return portfolio -/- return index)

Methods :

1. Full replication (copy the index)
2. Synthetic indexation (derivatives)
3. Sampling
 - stratified (minimize the bets)
 - optimized (minimize the tracking error)

Example:

**Track the MSCI Netherlands
index with 10 out of 26 stocks**

Start date : ultimo 30/06

Investments : 100.000 Euro

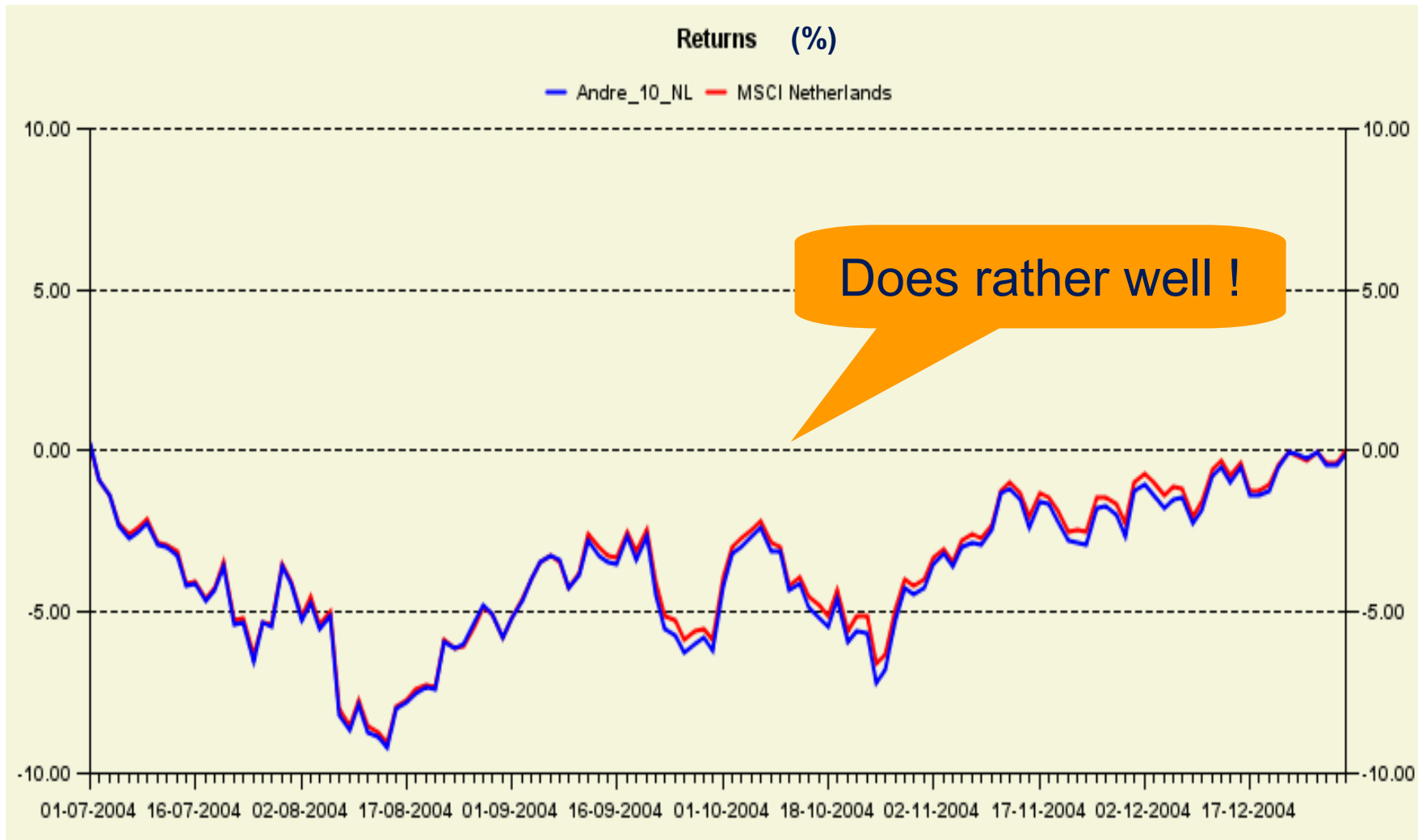
Index Tracking : Example MSCI Neth.

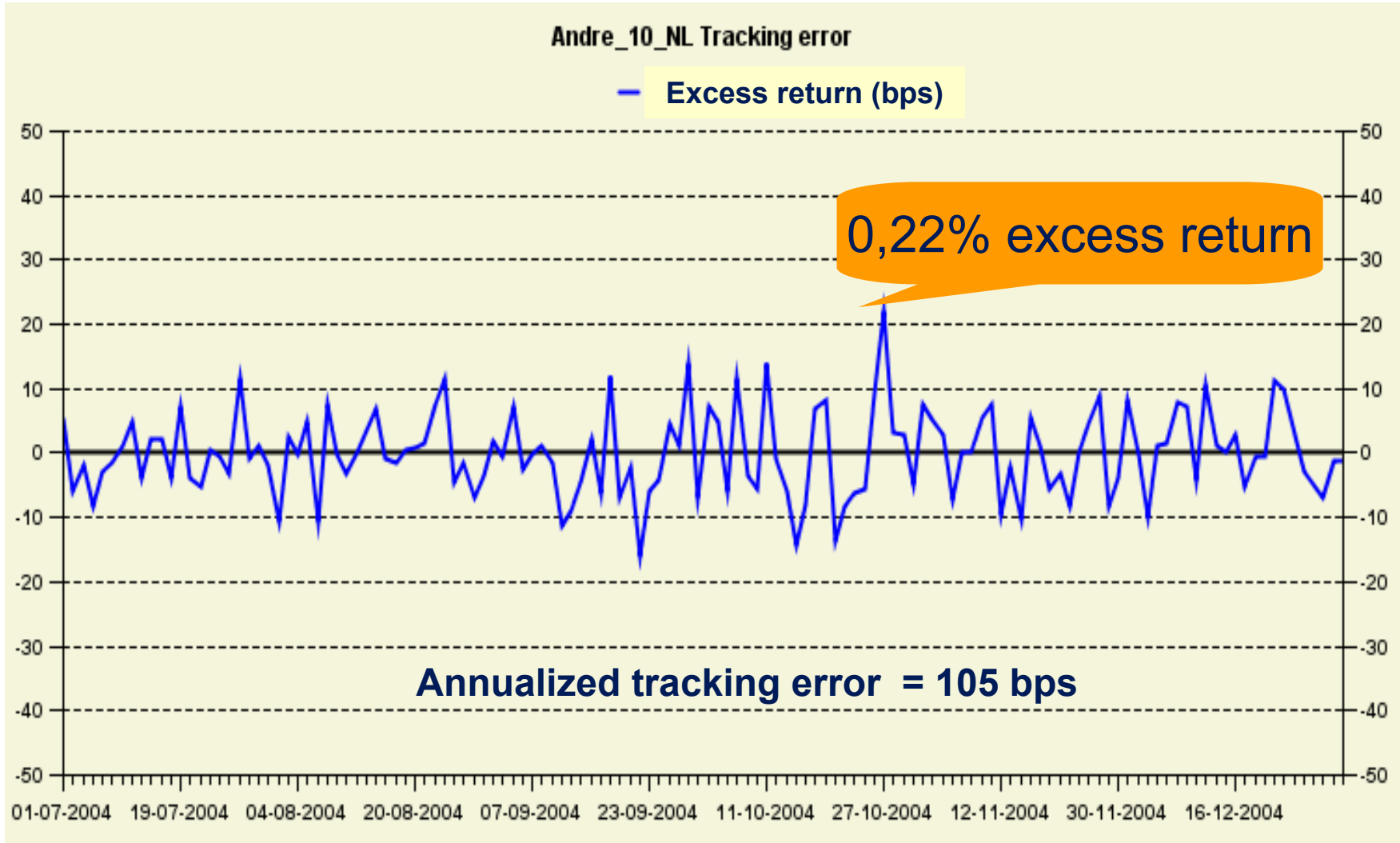
MSCI Netherlands

30/06/2004

Nr	Security	Weight	Price	Number	Amount
1	ROYAL DUTCH PETROLEUM CO	28.18%	42.10	706	29,722.60
2	ING GROEP	10.90%	19.40	642	12,454.80
3	UNILEVER NV CERT	10.28%	56.10	211	11,837.10
4	PHILIPS ELECTRS (KON.)	9.34%	22.13	492	10,887.96
5	ABN AMRO HOLDING	8.99%	17.98	586	10,536.28
6	AEGON	4.33%	9.91	594	5,886.54
7	KPN (KON.)	4.00%	6.26	887	5,552.62
8	AHOLD (KON.)	3.21%	6.45	739	4,766.55
9	AKZO NOBEL	2.64%	30.23	139	4,201.97
10	REED ELSEVIER (NL)	2.60%	11.54	360	4,154.40
11	ASML HLDG	2.15%	13.91	0	0.00
12	HEINEKEN NV	2.12%	27.01	0	0.00
13	TPG	1.88%	18.78	0	0.00
14	VNU	1.82%	23.87	0	0.00
15	WOLTERS KLUWER	1.33%	14.92	0	0.00
16	NUMICO (KON.)	1.27%	26.41	0	0.00
17	DSM	0.98%	40.33	0	0.00
18	RODAMCO EUROPE	0.71%	49.65	0	0.00
19	VEDIOR	0.63%	11.98	0	0.00
20	CORIO	0.48%	35.00	0	0.00
21	WERELDHAVE	0.45%	67.60	0	0.00
22	IHC CALAND	0.38%	38.23	0	0.00
23	GETRONICS	0.37%	2.25	0	0.00
24	OCE	0.33%	13.30	0	0.00
25	RANDSTAD HOLDING	0.33%	22.53	0	0.00
26	HAGEMEYER	0.27%	1.74	0	0.00
Total portfolio		100.00%			100,000.82

Index Tracking : Performance Error





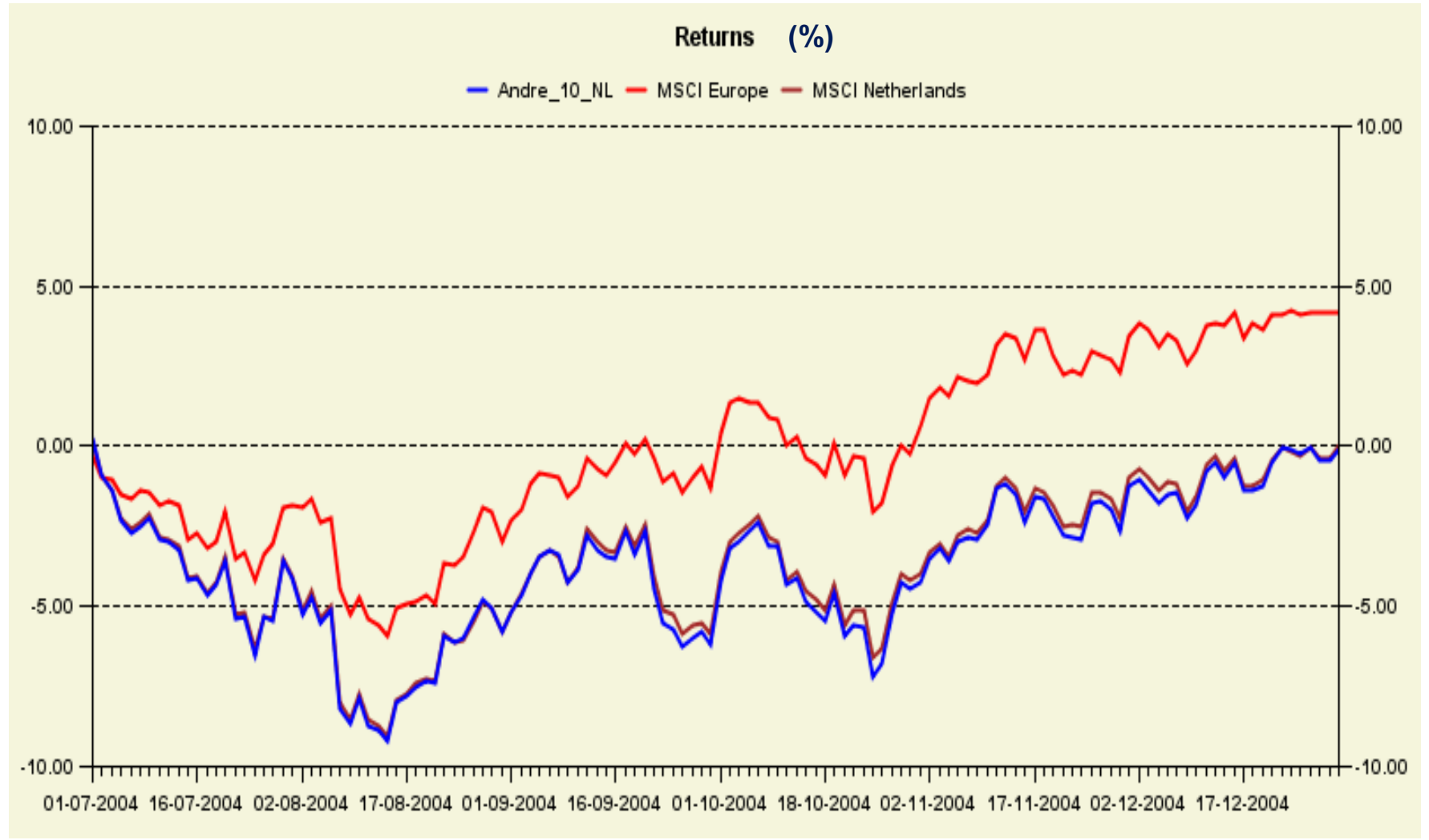
NB : tracking error = return portfolio -/- return index

Index Tracking : Attribution Report

Portfolio	Andre_10_NL	Portfolio Return	1.75%
Index	MSCI Netherlands	Index Return	1.53%
Date	27/10/2004	Weight Difference	31.25%

Security	PF Weight	Index Weight	Delta Weight	Performance	Excess
ROYAL DUTCH PETROLEUM CO	31.36%	29.44%	1.92%	0.55%	0.0105%
ING GROEP	13.75%	12.25%	1.50%	0.98%	0.0146%
ABN AMRO HOLDING	11.48%	9.73%	1.75%	-0.16%	-0.0028%
UNILEVER NV CERT	10.19%	8.78%	1.41%	-0.33%	-0.0046%
PHILIPS ELECTRS (KON.)	9.64%	8.21%	1.44%	-0.33%	-0.0047%
KPN (KON.)	5.90%	4.21%	1.68%	0.08%	0.0014%
AEGON	5.30%	3.87%	1.43%	0.75%	0.0108%
AHOLD (KON.)	4.15%	2.77%	1.38%	0.57%	0.0079%
AKZO NOBEL	4.34%	2.70%	1.64%	-0.74%	-0.0121%
REED ELSEVIER (NL)	3.89%	2.41%	1.48%	-0.93%	-0.0138%
HEINEKEN NV	0.00%	2.08%	-2.08%	-1.65%	0.0343%
TPG	0.00%	1.99%	-1.99%	-1.53%	0.0304%
ASML HLDG	0.00%	1.76%	-1.76%	-0.12%	0.0021%
VNU	0.00%	1.73%	-1.73%	-1.39%	0.0240%
WOLTERS KLUWER	0.00%	1.36%	-1.36%	-2.92%	0.0398%
NUMICO (KON.)	0.00%	1.32%	-1.32%	0.02%	-0.0003%
DSM	0.00%	1.11%	-1.11%	-2.27%	0.0253%
RODAMCO EUROPE	0.00%	0.81%	-0.81%	-1.43%	0.0116%
VEDIÖR	0.00%	0.68%	-0.68%	-0.54%	0.0037%
CORIO	0.00%	0.58%	-0.58%	-1.79%	0.0104%
WERELDHAVE	0.00%	0.49%	-0.49%	-1.17%	0.0057%
IHC CALAND	0.00%	0.47%	-0.47%	-1.15%	0.0054%
RANDSTAD HOLDING	0.00%	0.42%	-0.42%	-1.60%	0.0067%
OCE	0.00%	0.29%	-0.29%	-1.53%	0.0044%
GETRONICS	0.00%	0.28%	-0.28%	0.36%	-0.0010%
HAGEMeyer	0.00%	0.27%	-0.27%	-4.80%	0.0129%
TOTAL	100.00%	100.00%	0.00%		0.2225%

Index Tracking : impact of benchmark



- **Step 1 : Select stocks to be invested in.**
- **Step 2 : Find the portfolio weights that minimize the (in-sample) tracking error, such that**
 - **budget constraints,**
 - **sector constraints**
 - **currency constraints**
 - **country constraints****are met,**
taking into account the transaction costs.

Step 1 : Stock Selection

- Heuristics :
 - Largest Stocks
 - Most volatile stocks (with respect to index)
- Extension of Step 2 with integer variables.

*Largest Stocks heuristic works fine
(although can be refined, Jonas van Praag)*

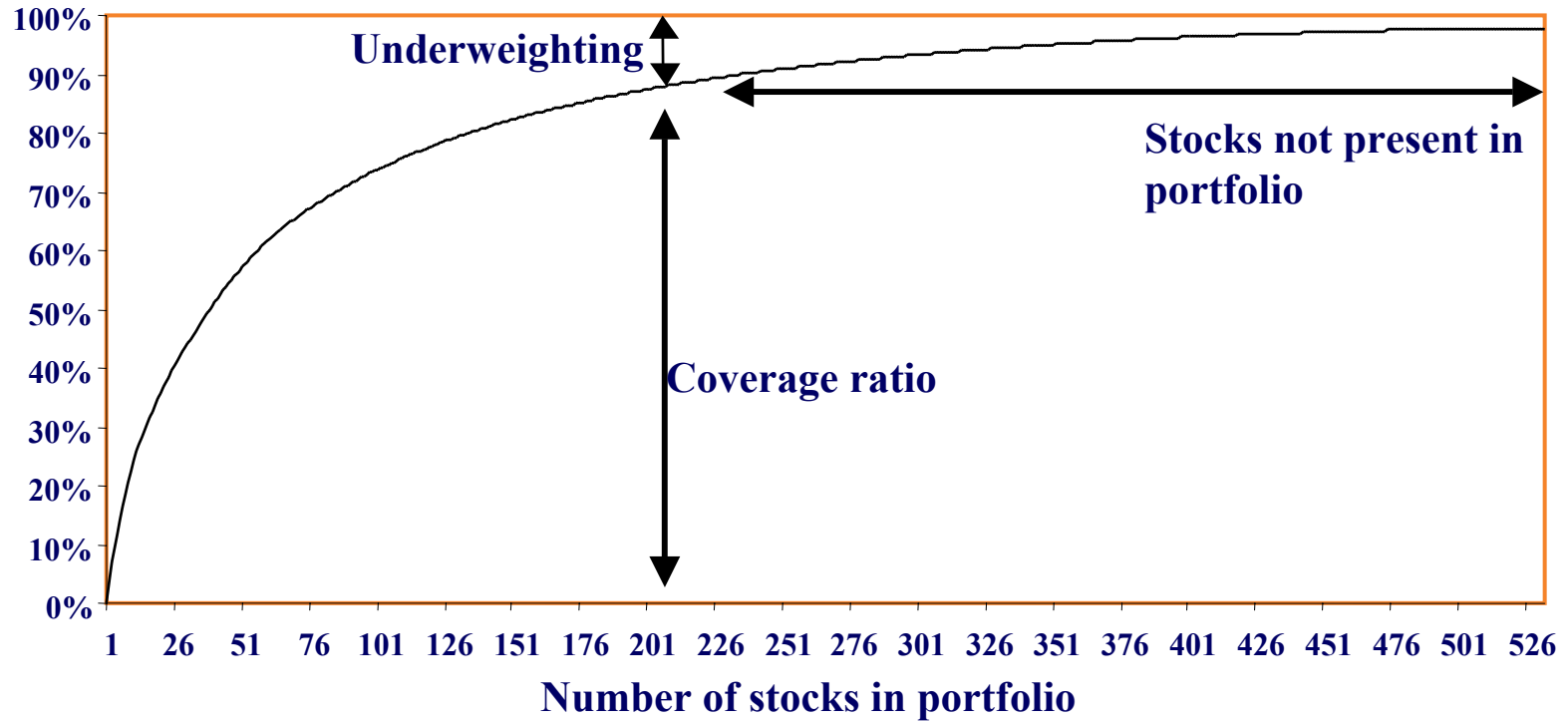
Step 2 : Determine weights of selected stocks

- Based on a historic period of 1 to 1.5 year, we minimize the sum of the tracking errors.
- This is a QP where the weights of the stocks are the decision variables.
- We minimize the squared sum of daily tracking errors.
- We add linear constraints for bounding the exposure in sectors, countries, currencies and individual stocks.
- Differences in weights (with respect to the portfolio bought earlier) are penalized.

The number of stocks in the portfolio, has the following impact on the performance error.

Aantal fondsen in MSCI Europe	Coverage ratio	Tracking error per jaar
200	87%	0.62%
250	91%	0.44%
300	93%	0.25%
500	99%	0.05%

The coverage ratio is the overlap between the portfolio and the index constituents.



**Return portfolio = return index index +
return overweighted stocks +
return underweighted stocks**

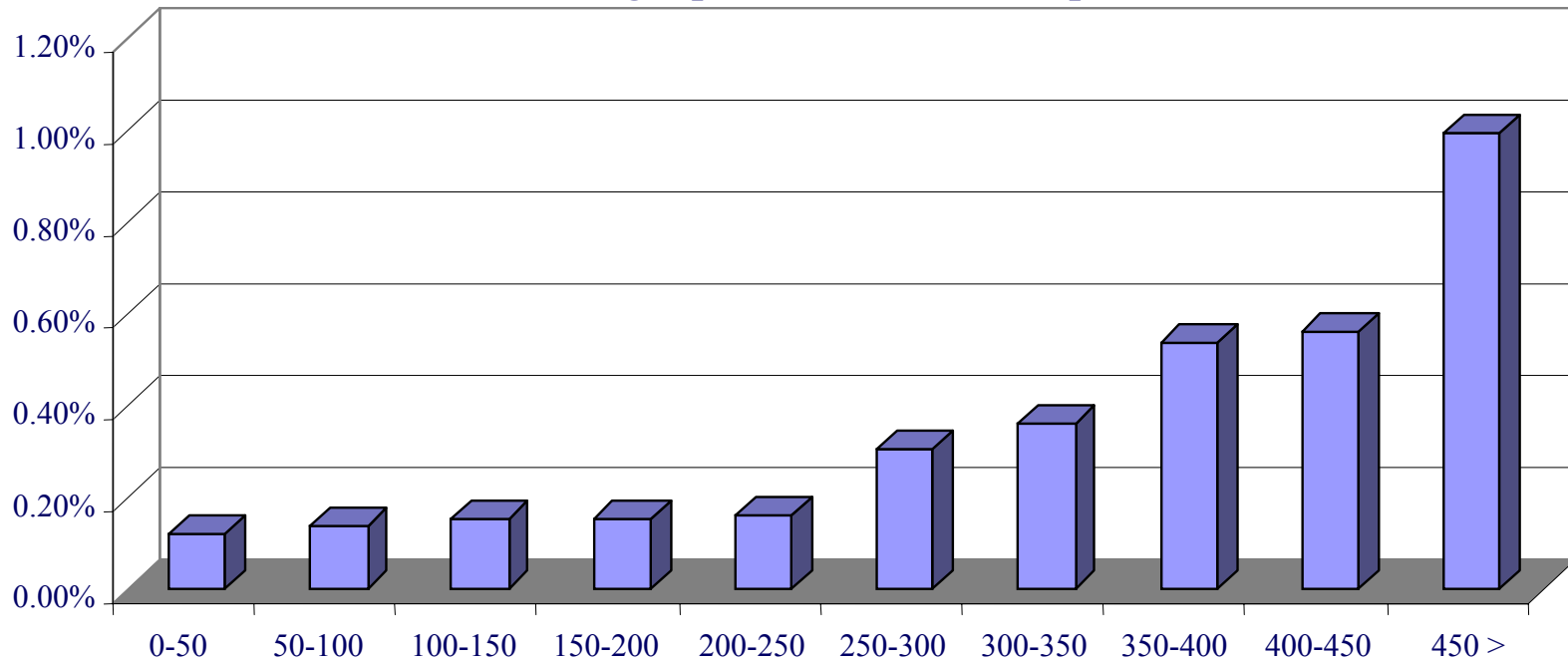
The relative risk consists of both the overweightings and the underweightings

Example

- **The selection consists of the 200 largest stocks**
- **Coverage ratio is 87%**
- **Underweightings are 13%**
- **Overweightings are 13%**
- **Relative Risk is 26%**

By buying only the largest stocks, we save on the soft transaction costs.

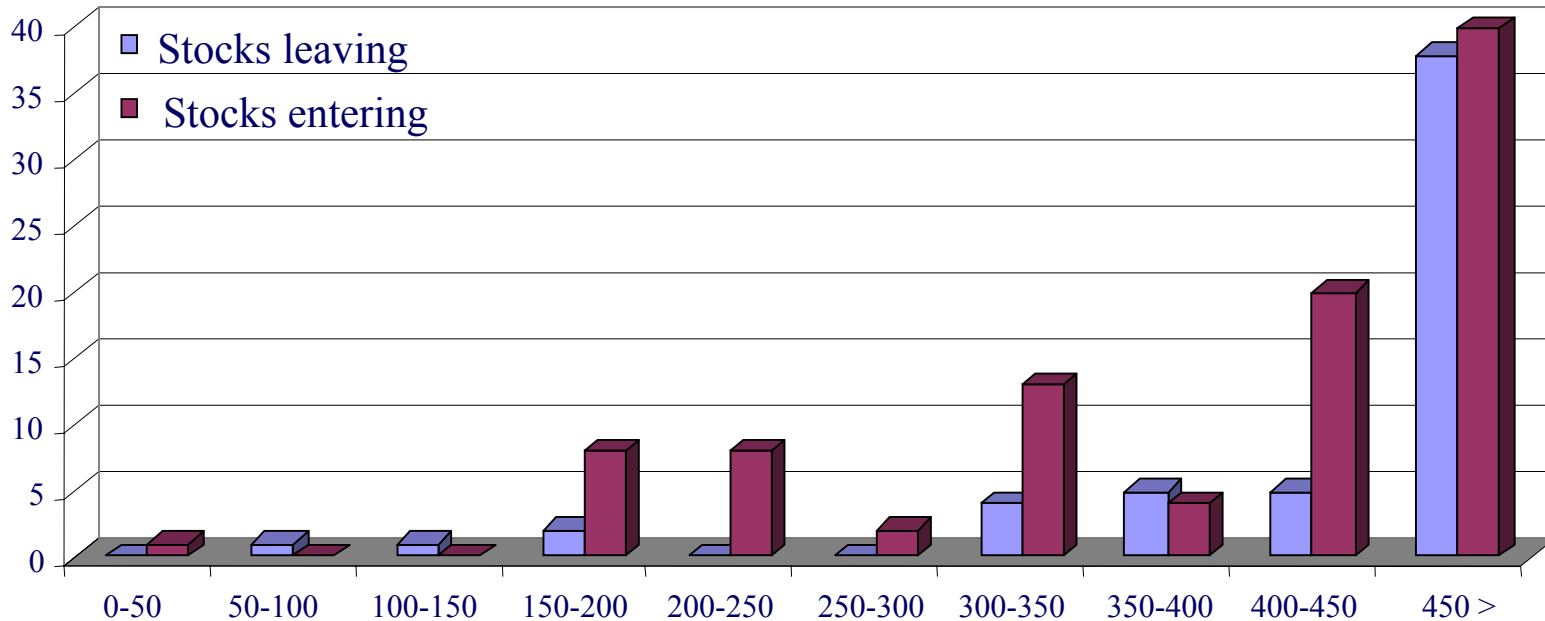
Average spread of MSCI Europe stocks



Ordered on market capitalisation.

By buying only the largest stocks, we save on transaction costs due to mutations of the index.

Stocks entering and leaving the MSCI Europe index on 30 november 2001



Ordered on market capitalisation.

PART III

ALM for Housing Corporations

How rich are housing corporations ?

Minister Dekker : “Corporaties hebben een overmaat aan vermogen en het is de verwachting dat deze vermogenspositie de komende jaren alleen maar beter wordt”, 6 november 2004 (+/- 15.000.000.000 EUR)

Housing corporations : “Het corporatie vermogen bedraagt 5.770 euro per woning. Net genoeg om een keukenblokje en een verwarmingsketel te vervangen”, 26 november 2004

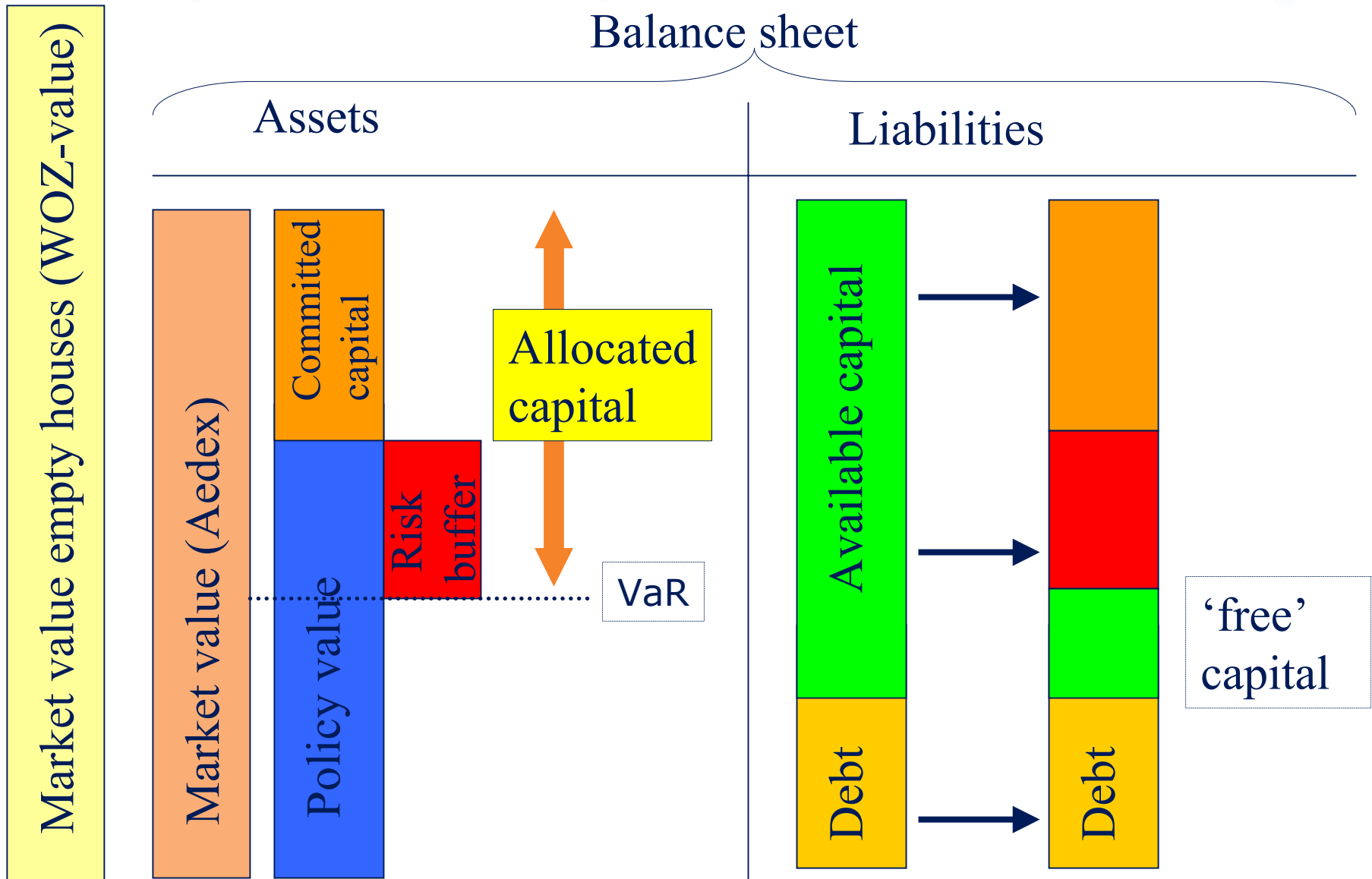
Cigar-box computations :

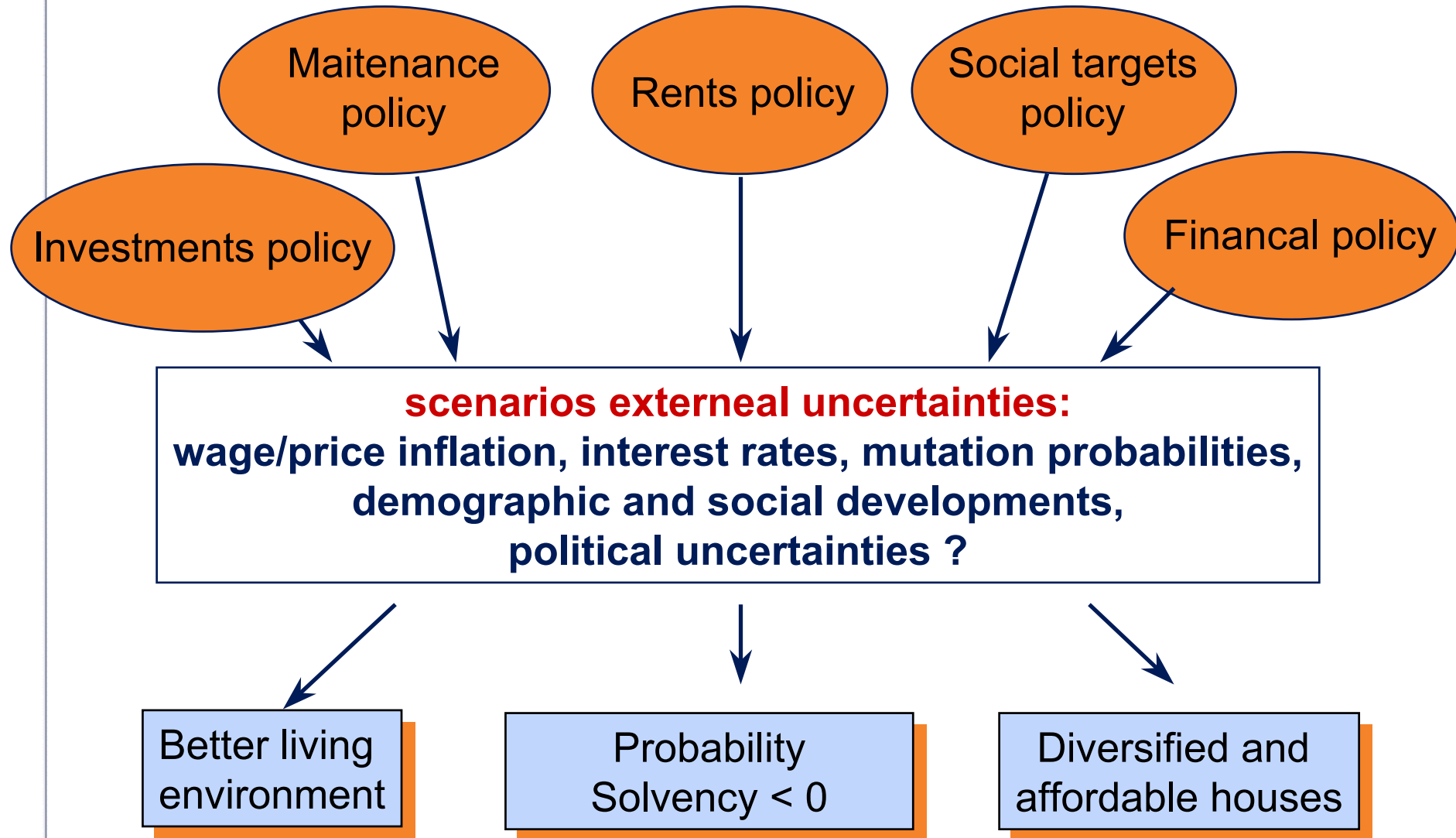
2,4 mln houses x 100.000 Euro each = 240.000.000.000 Euro

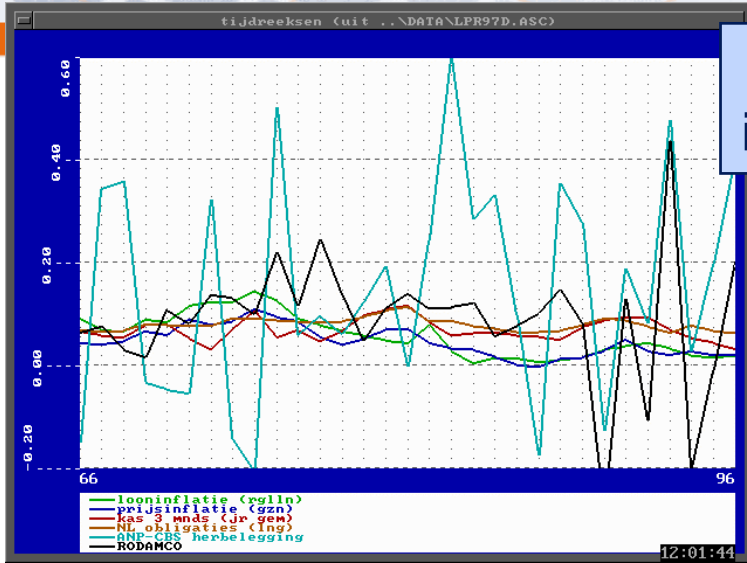
Private loans (debt) = 40.000.000.000

Net Asset Value = 200.000.000.000 !!

Where is this money hidden ?



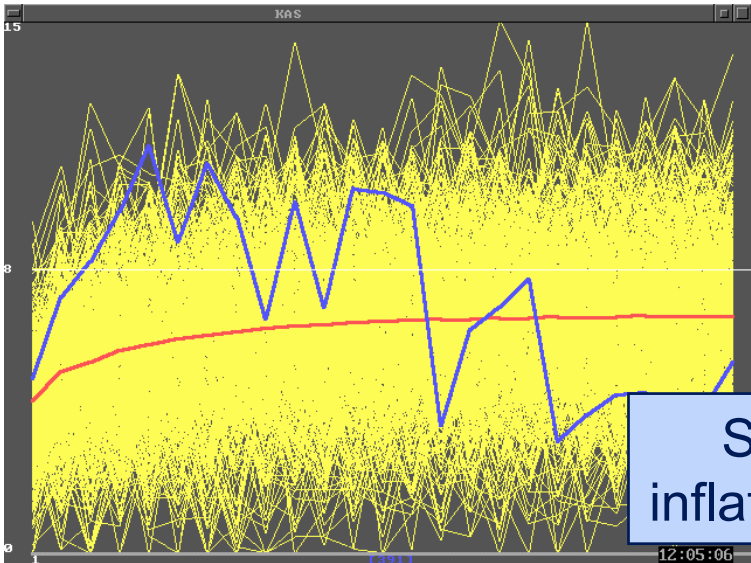
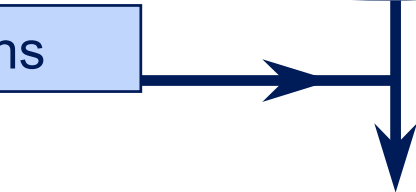




Series of historic inflation and returns

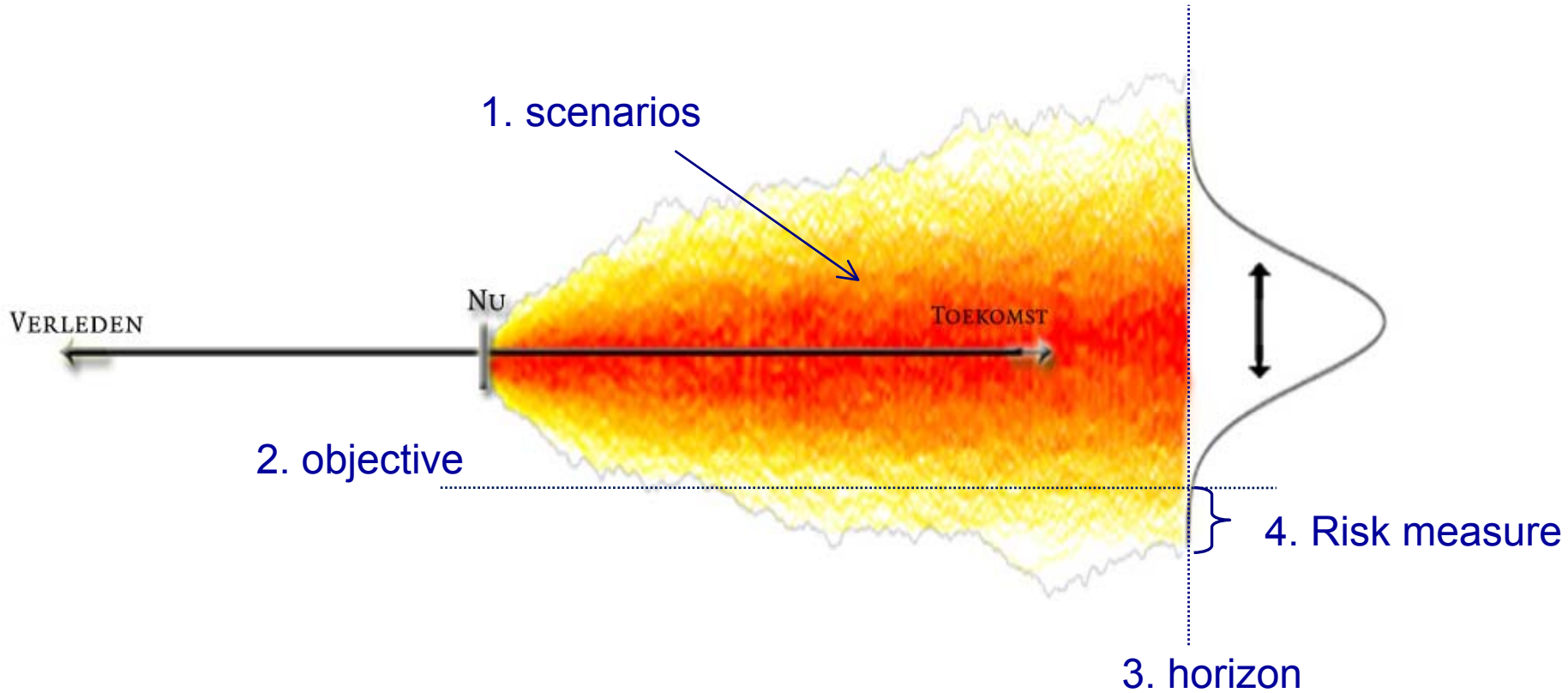


Own expectations

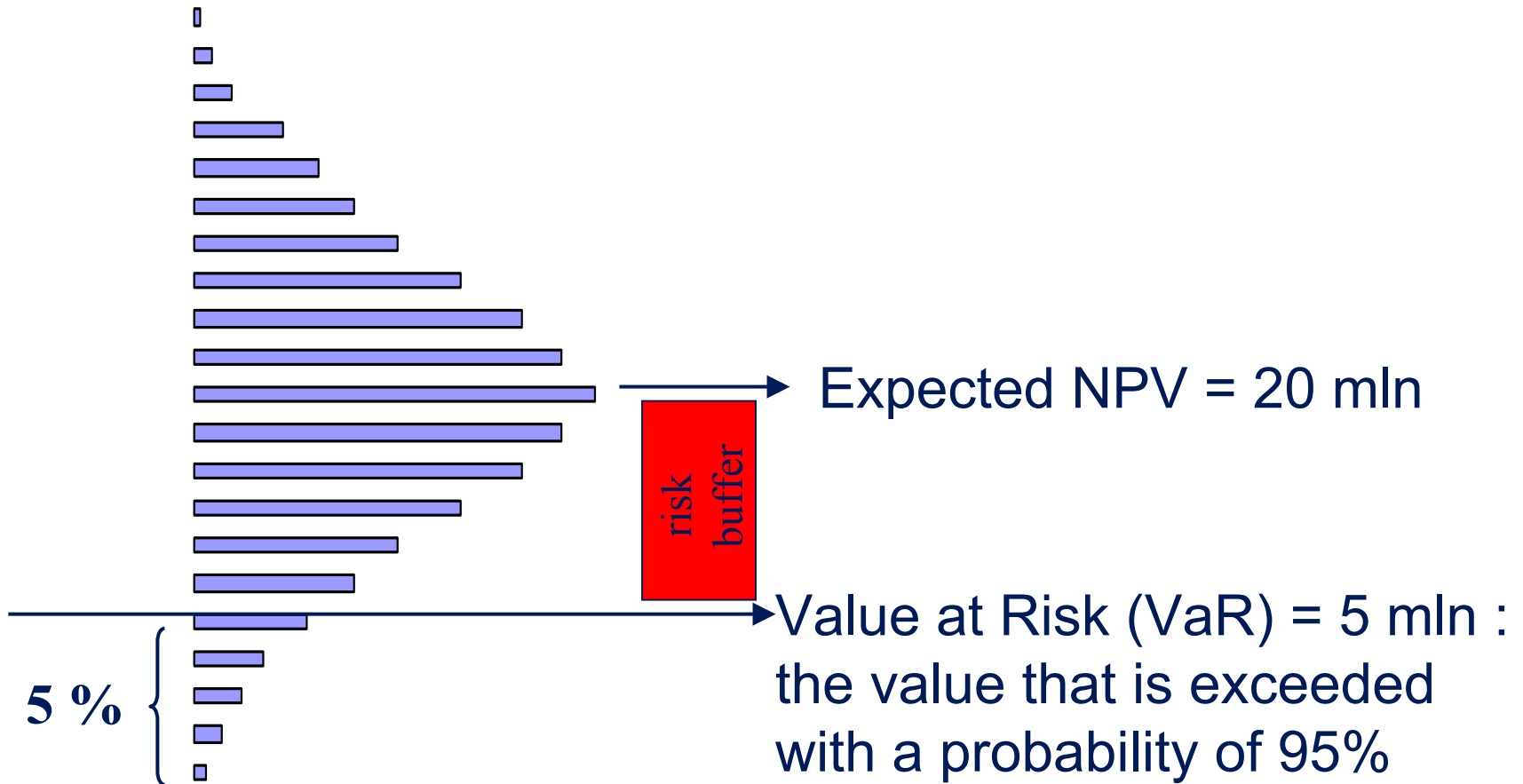


Scenario's of inflation and returns





Value-at-Risk: popular risk measure



Scenarios not only for :

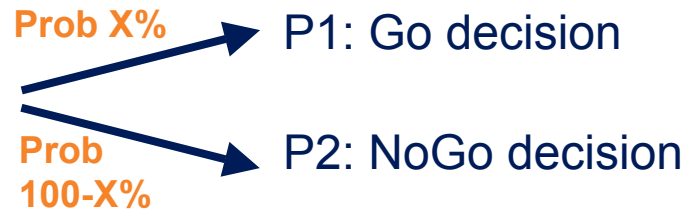
- Economic uncertainties (prices, wages, RE, interest rates, GDP,.....)
- Mutation speed (new rental contracts for individual houses)

But also for

- Project risks
 - Delay (in years, uniform distribution, min, max)
 - Go - NoGo decisions on next phase of project
 - Initial investments (in euro's, uniform distribution, min, max)

Integration of project risk

Project risk:

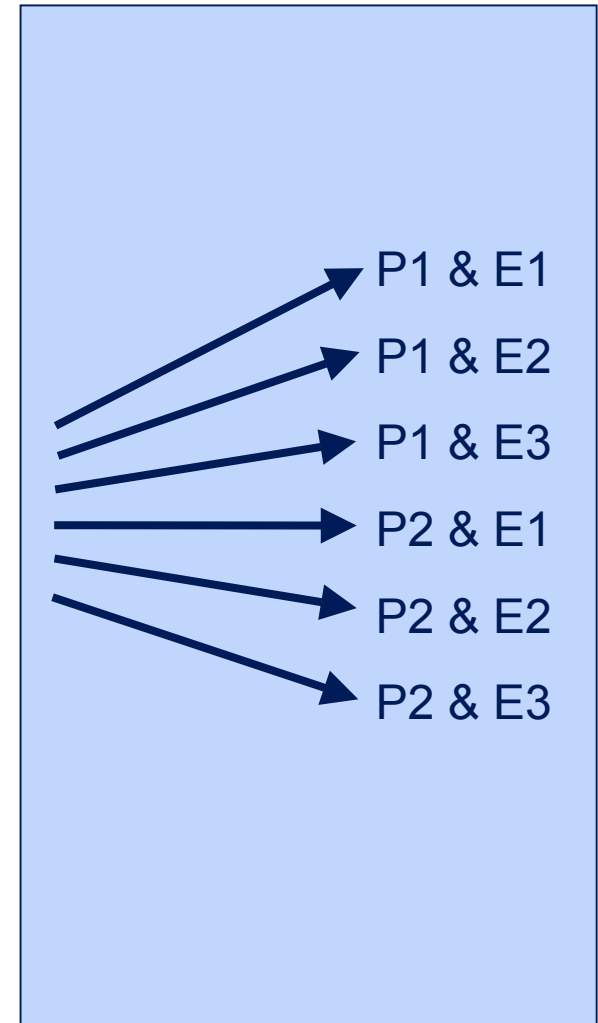


Probability depends on planning status

Economic risk:



Probabilites depend on historic data + vision



Example project

