

# Decision-Based Performance & Risk Evaluation

Round-Table "Performance Attribution"

Zurich, 12 March 2003

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  - Fixed Income Attribution
  - Sample IDP and Reports
  - PEARL System



ORTEC

# 1. ORTEC

# ORTEC

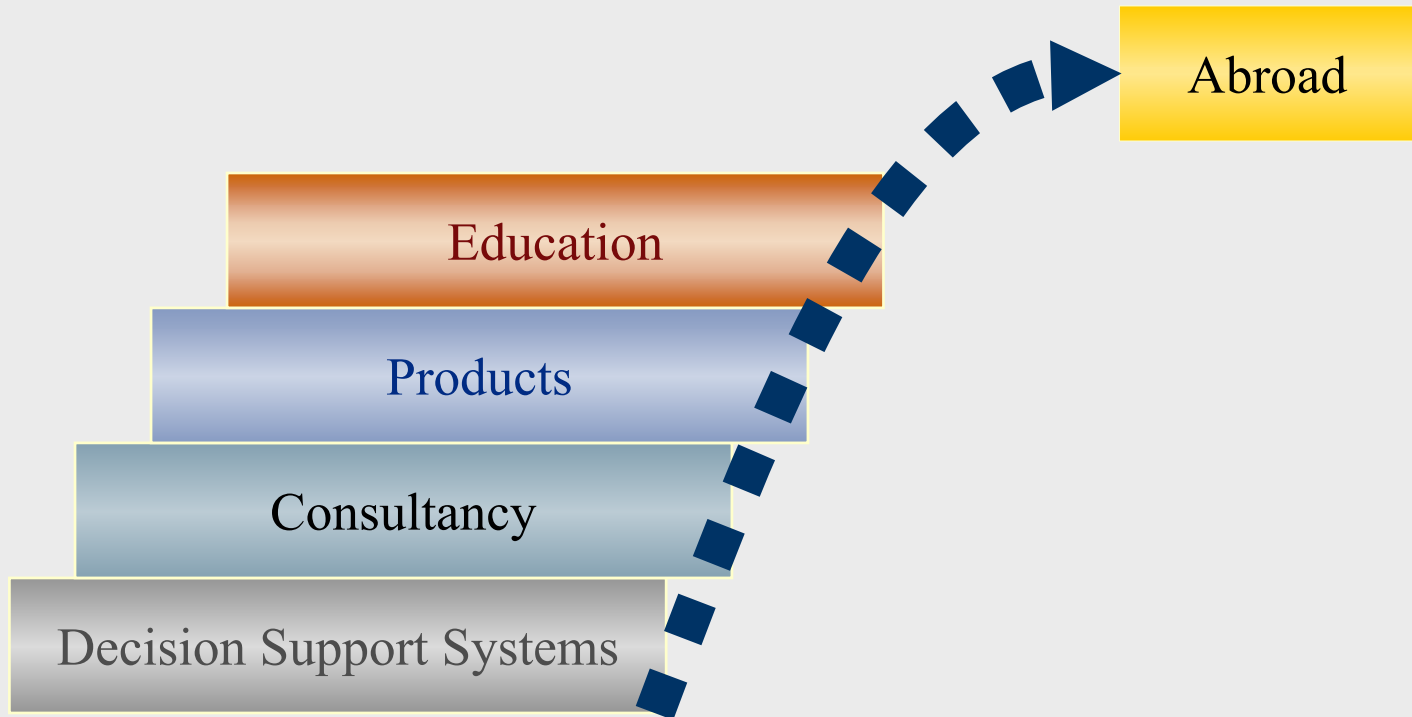
## Company Profile ORTEC

- ▶ **Business Description:** ORTEC provides optimization-based decision support software and services to clients across a wide variety of industries including Financial Services, Transportation & Logistics, Aviation and Workforce Management.
- ▶ **Founded:** April 1981
- ▶ **Products/Services:** Custom Software Applications, “Off-the-shelf” Software Products, Professional Consulting Services
- ▶ **Number of employees:** Over 350
- ▶ **Representative Clients (500+):** The World Bank, ABP, ABN-AMRO, Shell, Philips, Yellow Freight System, BP Amoco, Deutsche Post, Maersk, Danzas AEI, TNT, KLM, Hapag Lloyd, BASF, IBM, Airbus, Banque Paribas, Fortis, ING, .....
- ▶ **The ORTEC Advantage:** Business driven optimization experts that deliver real working practical solutions. We deliver what we promise.

# Corporate Strategy

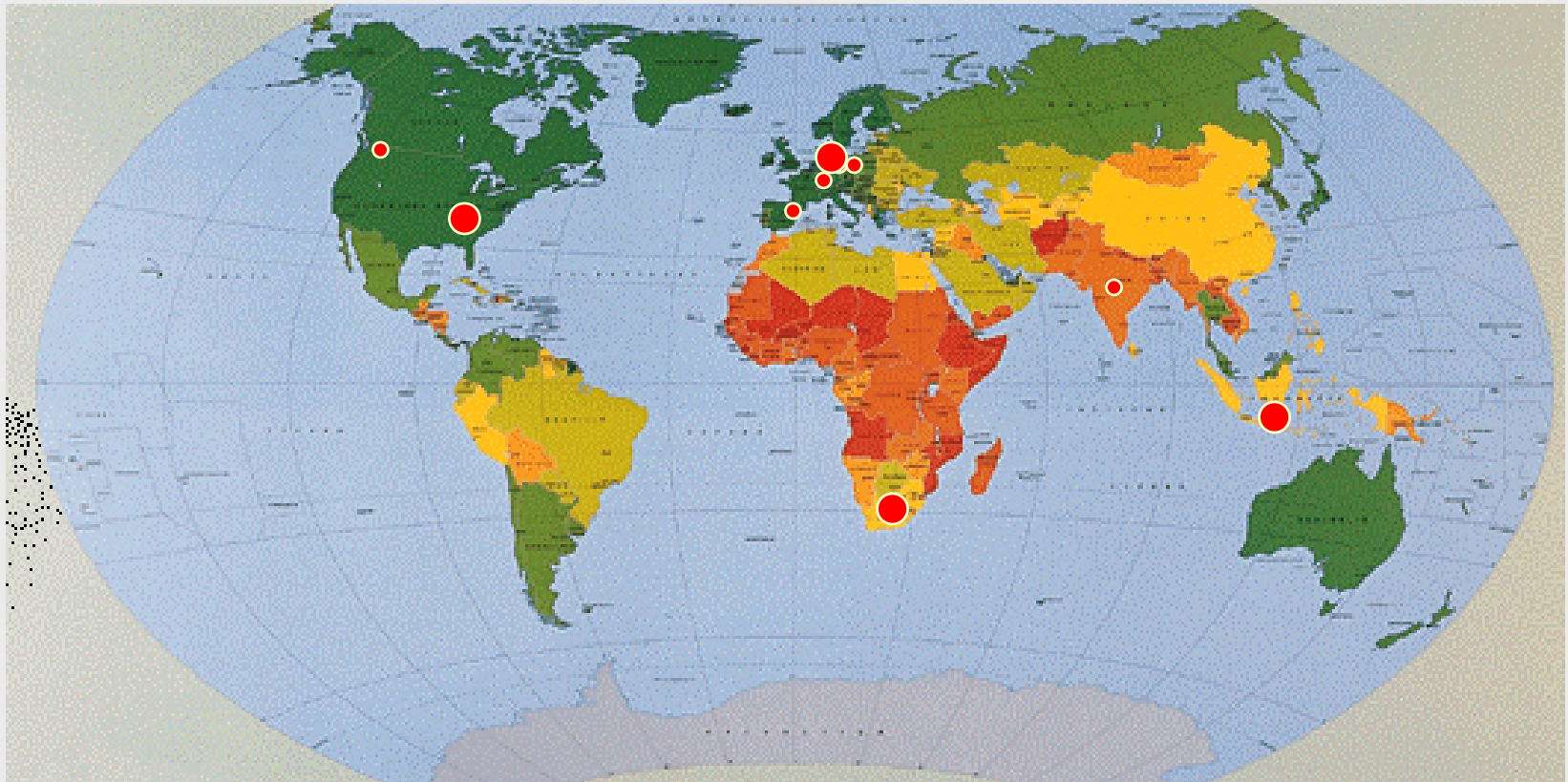
Services:

Tailor-made Decision Support Systems  
 Consultancy  
 Standard Products



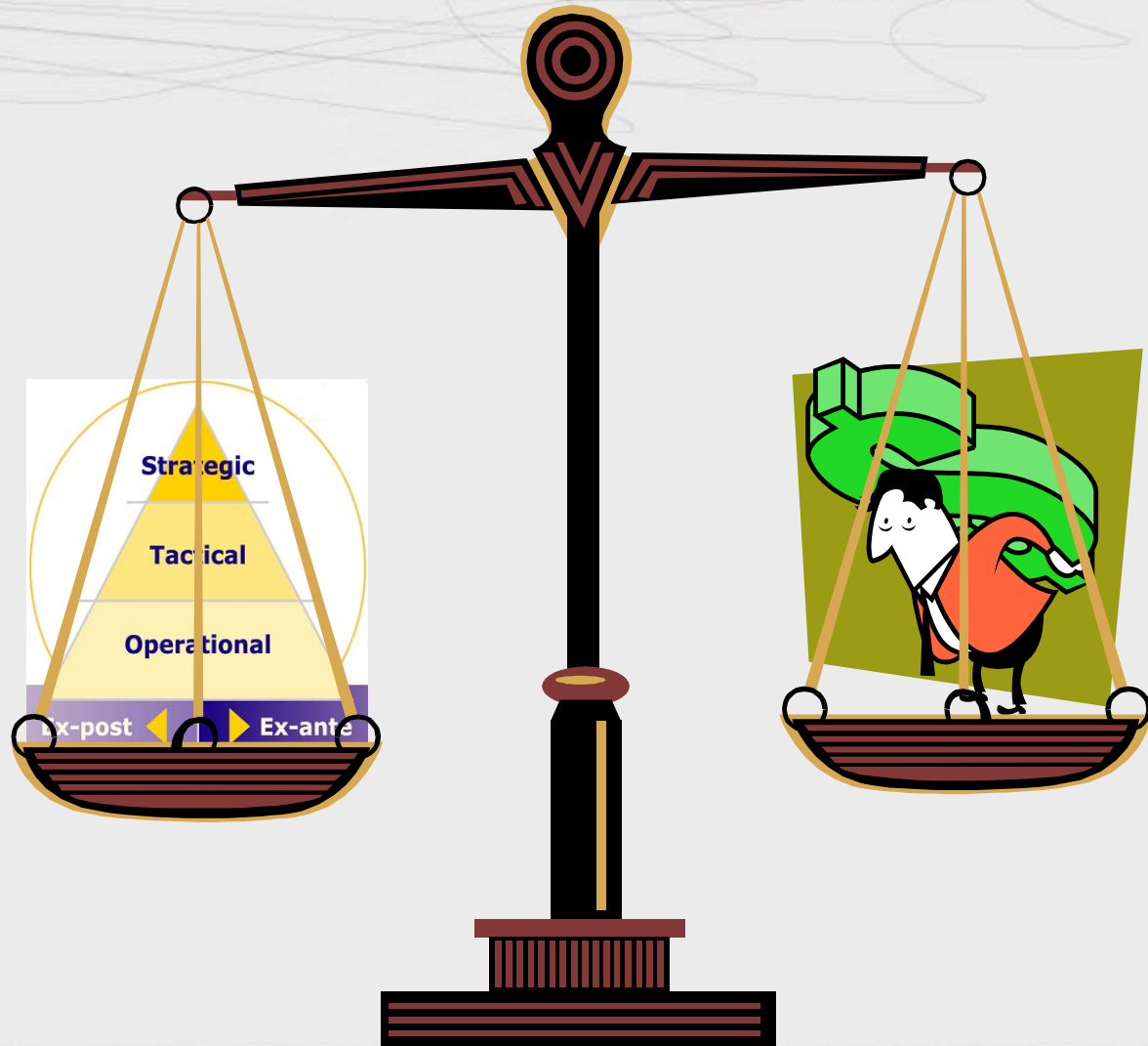
## Global Presence

- ▶ **Global solutions with local support:** ORTEC has offices in Europe (HQ), Asia, Africa and the United States



# ORTEC Finance Paradigm

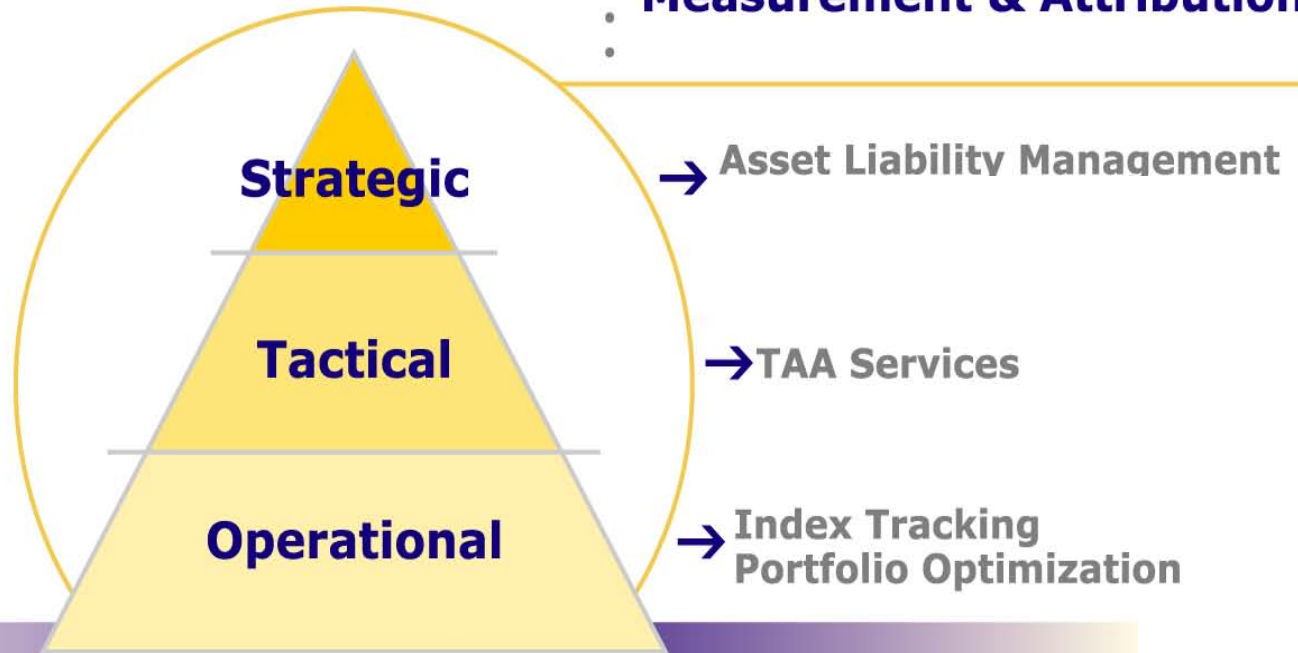
- ▶ Running the financials of an organization starts with sound Asset Liability Management
- ▶ Liabilities set the benchmark for the Asset Management Process



# Asset Management = IDP

## Investment Decision Process

Performance & Risk  
Measurement & Attribution



Ex-post



Ex-ante

## ▶ ORTEC Finance Product Line

### ▶ **Asset Liability Management**

PALM; Pension funds, Insurance companies and Banks

WALS; Housing Corporations

OPAL; Individuals (retirement planning, high net worth investors)

### ▶ **Performance Evaluation, ex-post Risk Management**

PEARL

### ▶ **Ex-ante Risk Management**

AMBER (seamlessly integrated with PEARL)

### ▶ **Investment Benchmarking Services**

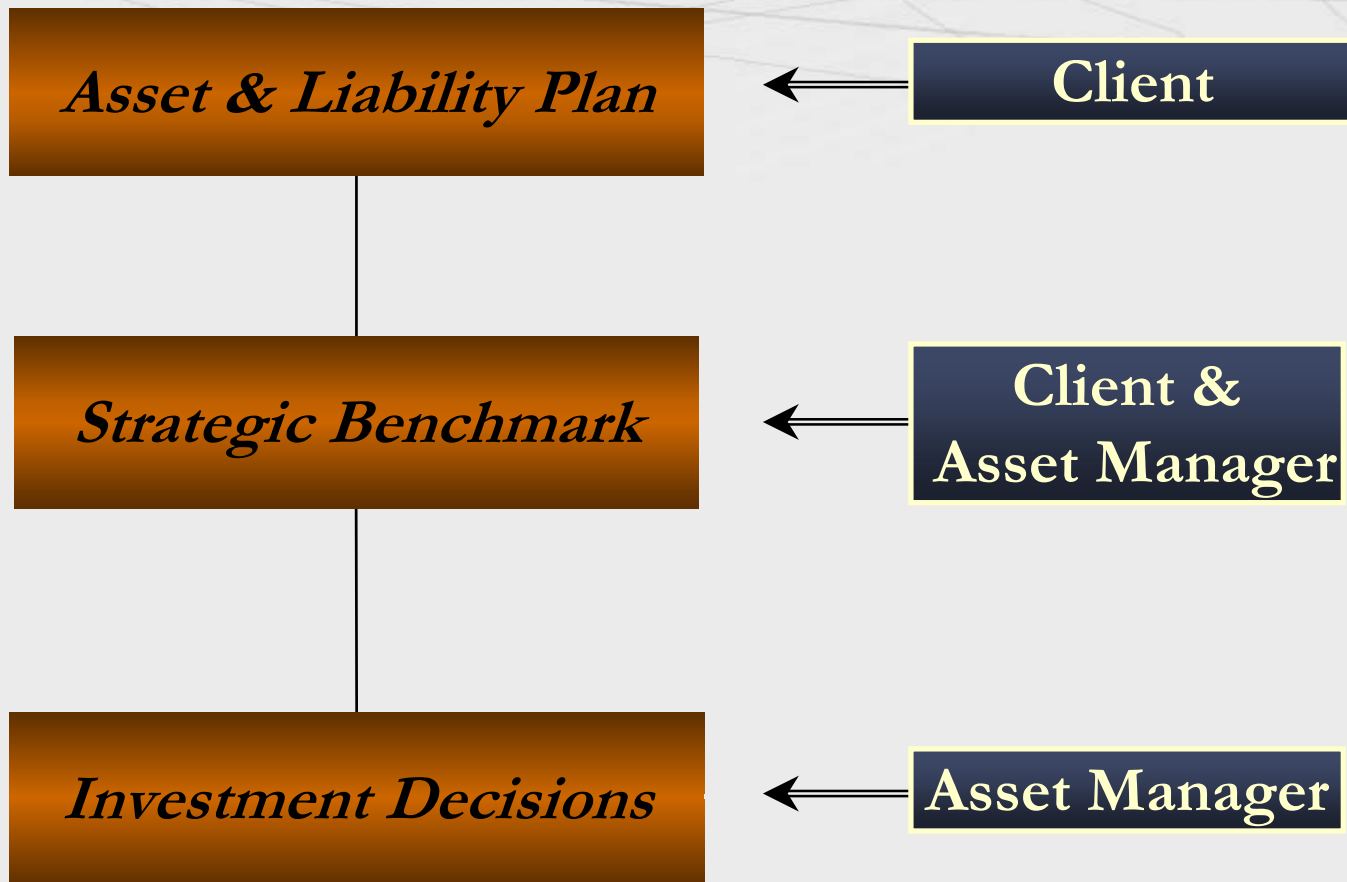
IBS (CEM)

### ▶ **Index Tracking**

IT

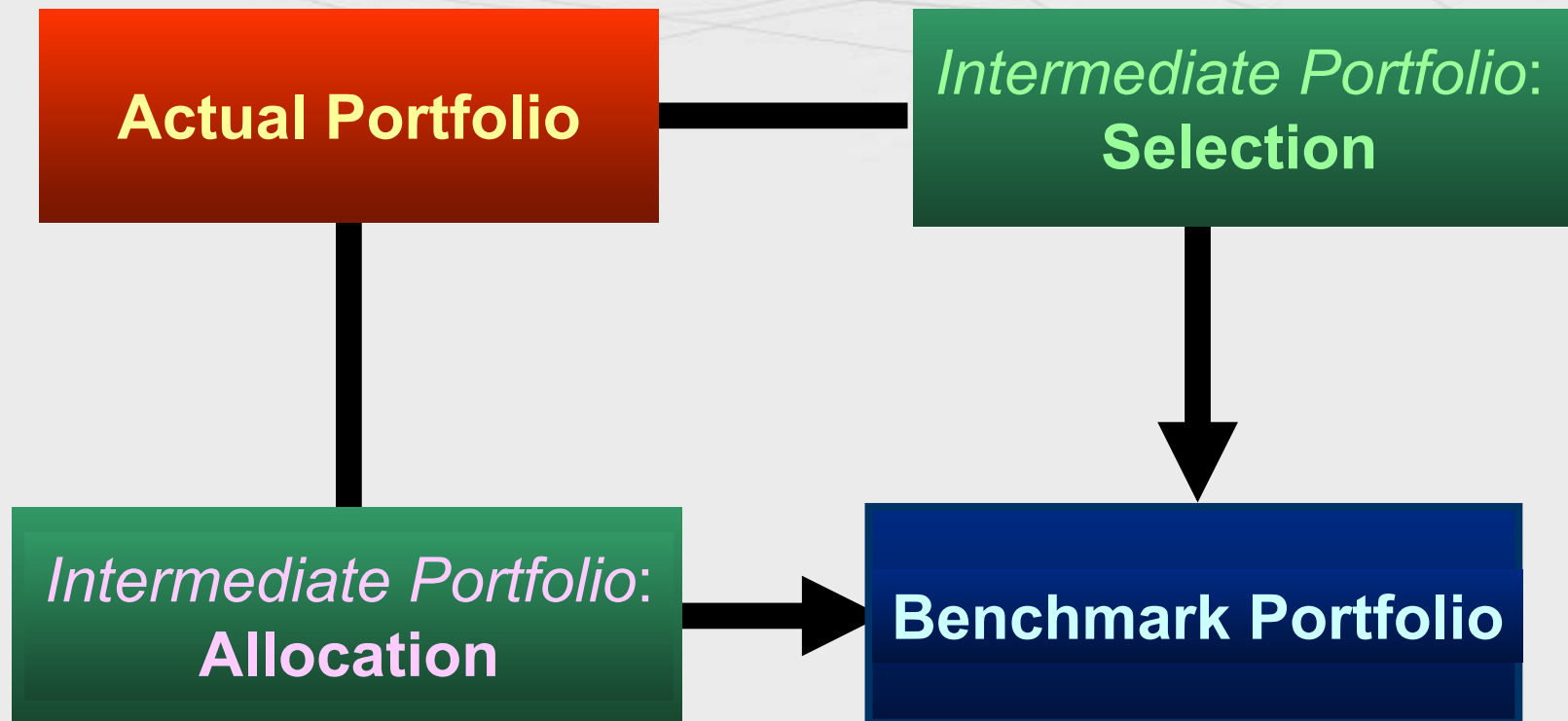
## 2. Investment Decision Process (IDP) Model

# Investment Mandate



**Multiple layer, hierarchical decision model.**

## Two Decisions



Simple two layer decision model



Modeling more layers requires the IDP model

## Investment Decision Process (IDP)

### ▶ Objective

- ▶ The IDP model forms a factual reflection of reality by disentangling the investment process in multiple, rightly ordered decisions; it calculates the contribution of these decisions to the overall (excess) result;

### ▶ Proposition

- ▶ Each structured investment process can be considered as a succession of allocation and selection decisions. This is called the hierarchy of an investment process;

### ▶ Requirements

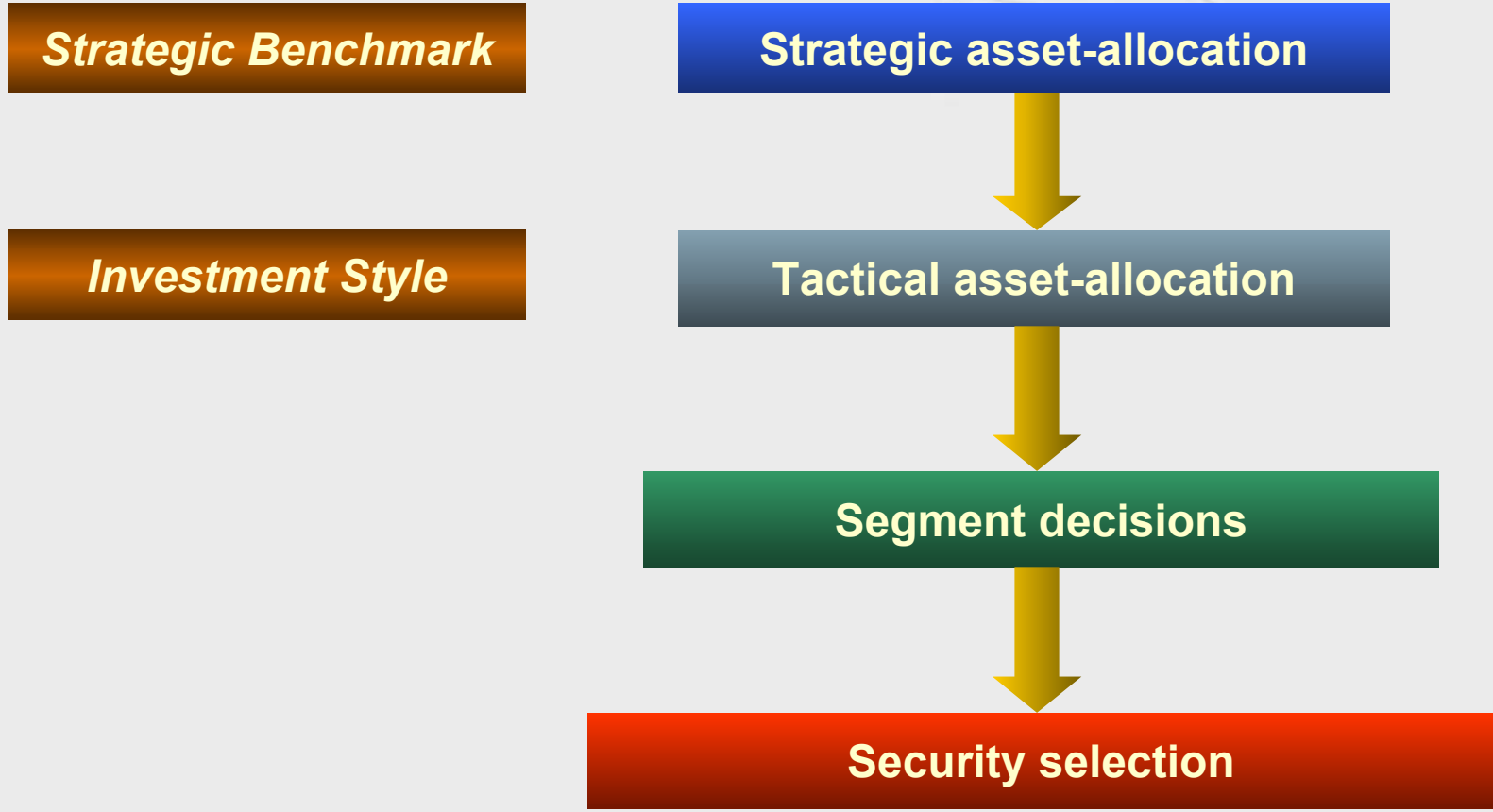
- ▶ Each decision serves as a benchmark for the subsequent decision,
- ▶ Each decision is complete (no value is lost),

## ▶ IDP-Model

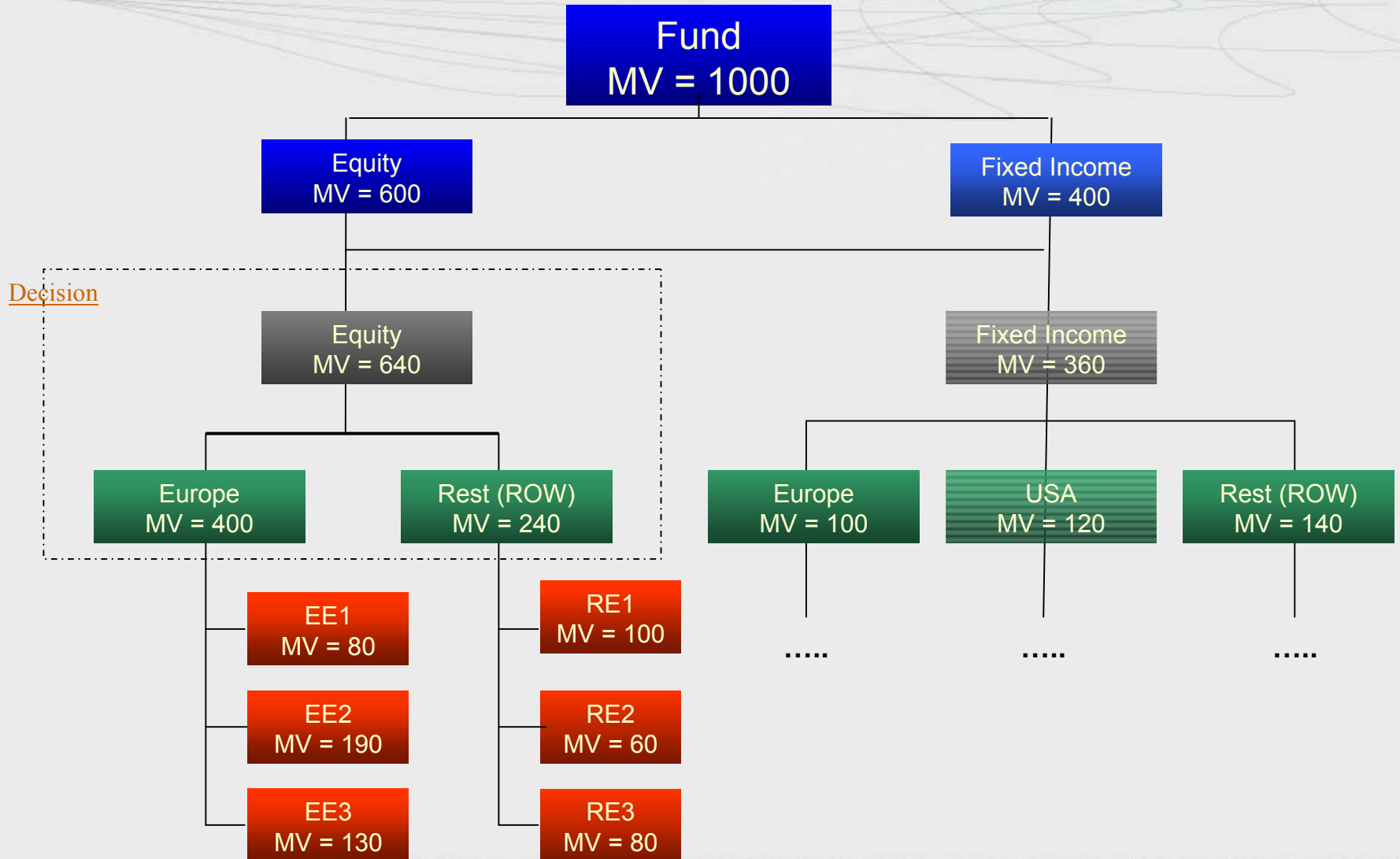
**Before modeling the IDP, the following questions need to be answered:**

- Which decisions are made?
- In what sequence are the decisions made?
- How do we evaluate these decisions?
- Which attribution-methods are suitable?

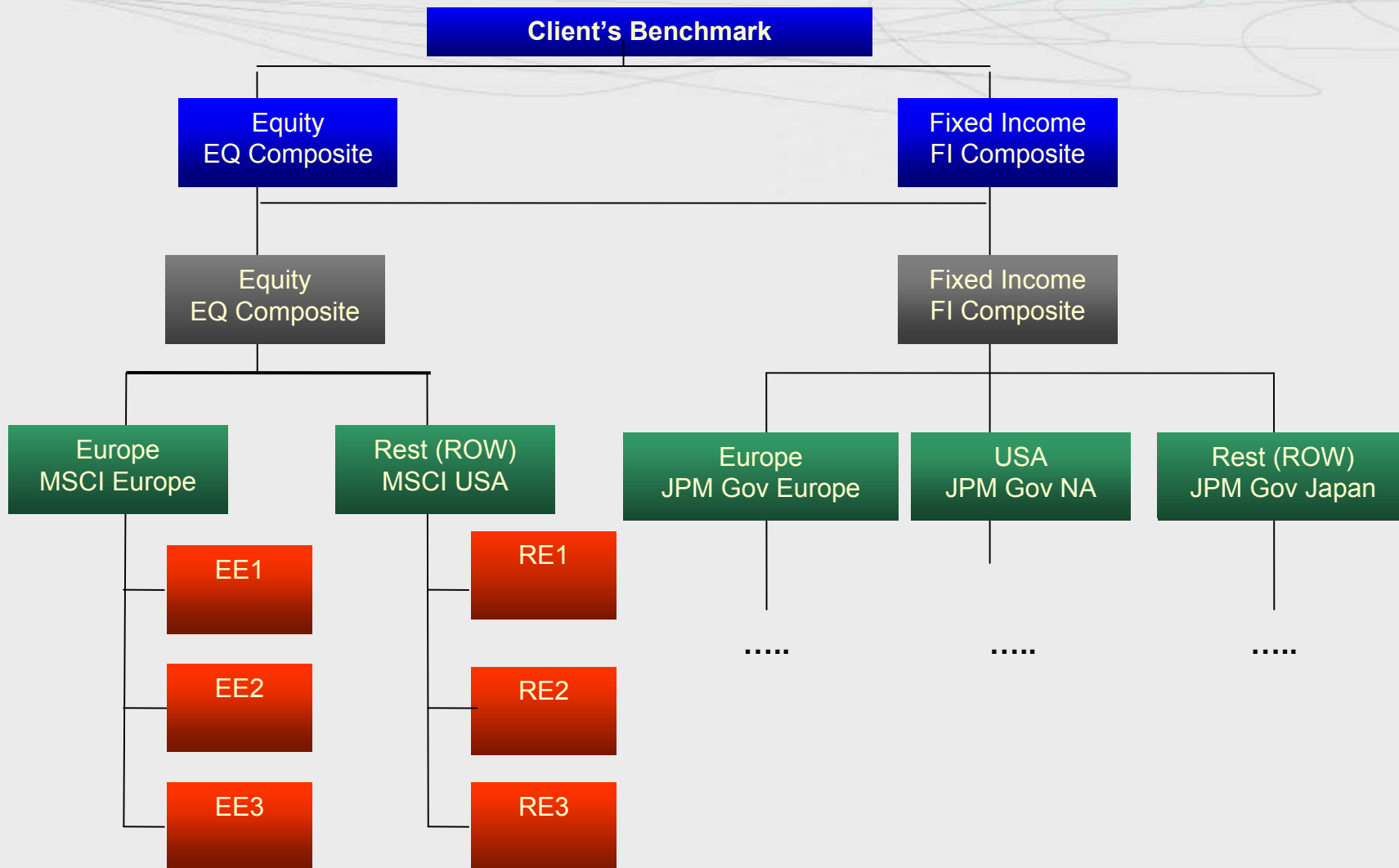
▶ Example IDP



# Portfolio Hierarchy



# Benchmark Hierarchy



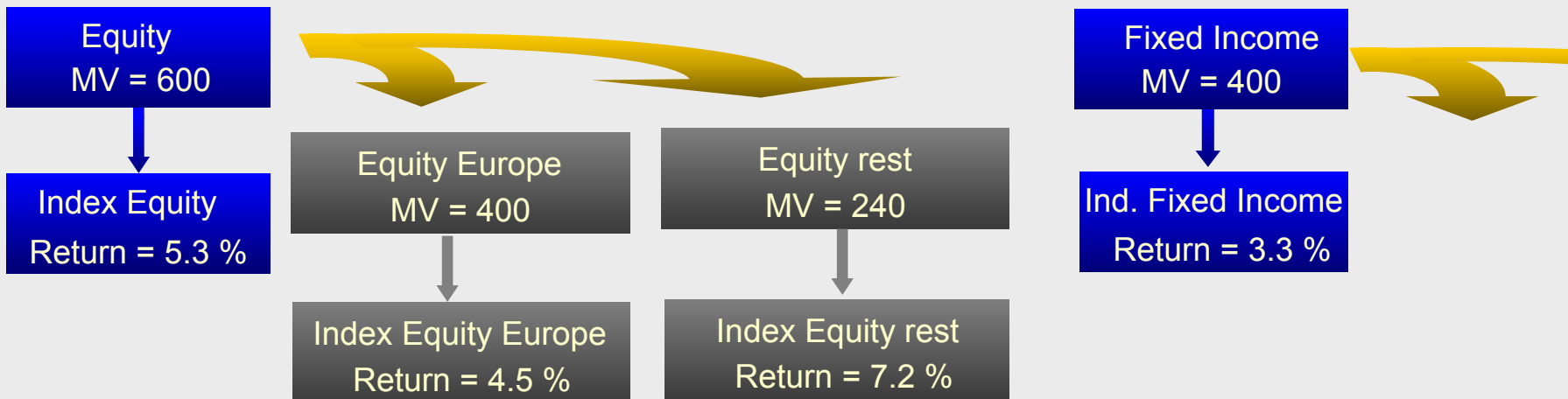
# Return of a Decision

- Each decision consists of investments

Strategic decision MV = 1.000	=	Equity MV = 600	+	Fixed Income MV = 400
----------------------------------	---	--------------------	---	--------------------------

Regional decision equity MV = 640	=	Equity Europe MV = 400	+	Equity Rest MV = 240
--------------------------------------	---	---------------------------	---	-------------------------

- Each decision yields a return



# Return of a Decision

Equity Europe MSCI Europe	
MV	= 400
Return	= 4.5%
Gain	= $400 \times 4.5\% = 18$

+

Equity rest (ROW) MSCI USA	
MV	= 240
Return	= 7.2%
Gain	= $240 \times 7.2\% = 17.3$



Regional decision equity	
MV	= $400 + 240 = 640$
Gain	= $18 + 17.3 = 35.3$
Return	= $35.5 / 640 = 5.5\%$

## Excess Results

Each decision is complete and serves as benchmark for the next decision



When we compare decisions we can determine the added value (excess result) of a decision



Excess result decision =  
Return of decision -/- Return previous decision

# Excess Result, tactical asset allocation

**Strategic decision**

Equity	Fixed Income
MV = 600	MV = 400
Return = 5.3 %	+ Return = 3.3 %
Gain = 31.8	Gain = 13.2

MV = 1000  
Gain = 45.0

Excess result tactical decision  
= 45.8 - 45.0 = 0.8

**Tactical decision**

Equity	Fixed Income
MV = 640	MV = 360
Return = 5.3 %	+ Return = 3.3 %
Gain = 33.92	Gain = 11.88

MV = 1000  
Gain = 45.8

# Excess Result, regional decision

## Tactical decision

Equity  
 MV = 640  
 Return = 5.3 %  
 Gain = 33.92

MV = 640  
 Gain = 33.9

Excess result regional decision equities  
 = 35.3 - 33.9 = 1.4

## Regional decision equities

Equity Europe		Equity Rest
MV = 400		MV = 240
Return = 4.5 %	+	Return = 7.2 %
Gain = 18.00		Gain = 17.28

MV = 640  
 Gain = 35.3

# Excess Result, stock picking

## Regional decision Equity Europe

Equity Europe  
 MV = 400  
 Return = 4.5 %  
 Gain = 18.00

MV = 400  
 Gain = 18.0

Excess result stock picking Europe  
 = 16.3 - 18.0 = -1.7

## Stock picking Equity Europe

EE1	EE2	EE3
MV = 80	MV = 190	MV = 130
Return = 6%	Return = 4%	Return = 3%
Gain = 4.8	Gain = 7.6	Gain = 3.9

MV = 400  
 Gain = 16.3

(Excess result stock picking Equity Rest: -0.5)

# Analysis Excess Results

▶ **Benchmark equity:**

MV = 640  
 Gain = 33.9  
 Return = 5.3%

▶ **Actual investments equity:**

MV = 640  
 Gain = 33.1  
 Return = 5.2%

▶ **Excess return equity:**

Gain = 33.1 - 33.9 = -0.8  
 Return = 5.2% - 5.3% = -0.1%

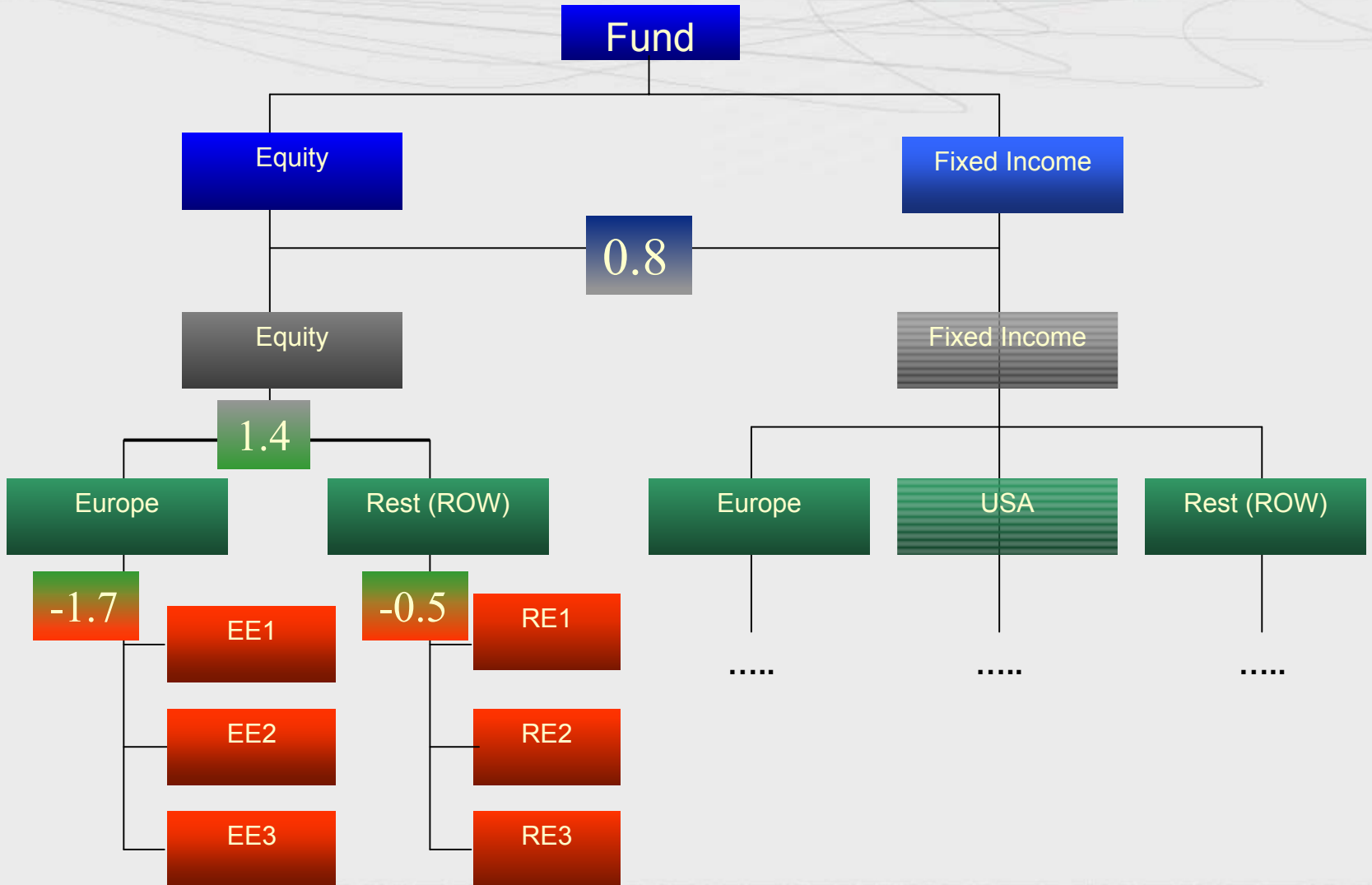
# Analysis Excess Results

	Gain	Return	
Tactical asset allocation equity	33.9	5.3% (= 33.9/640)	
Contribution regional decision equity	1.4	0.2% (= 1.4/640)	
Contribution stock picking Europe	-1.7	-0.4% (= -1.7/400)	
Contribution stock picking Rest	-0.5	-0.1% (= -0.5/240)	+
<hr/>			
Total result equity	33.1	5.2% (= 33.1/640)	

Added value all equity decisions = Excess result equity =  
 $(1.4) + (-1.7) + (-0.5) = -0.8 \Rightarrow -0.1\% (= -0.8/640)$

Added value stock picking equity =  $(-1.7) + (-0.5) = -2.2 \Rightarrow -0.3\% (= -2.2/640)$

# Excess Gain Results Hierarchy



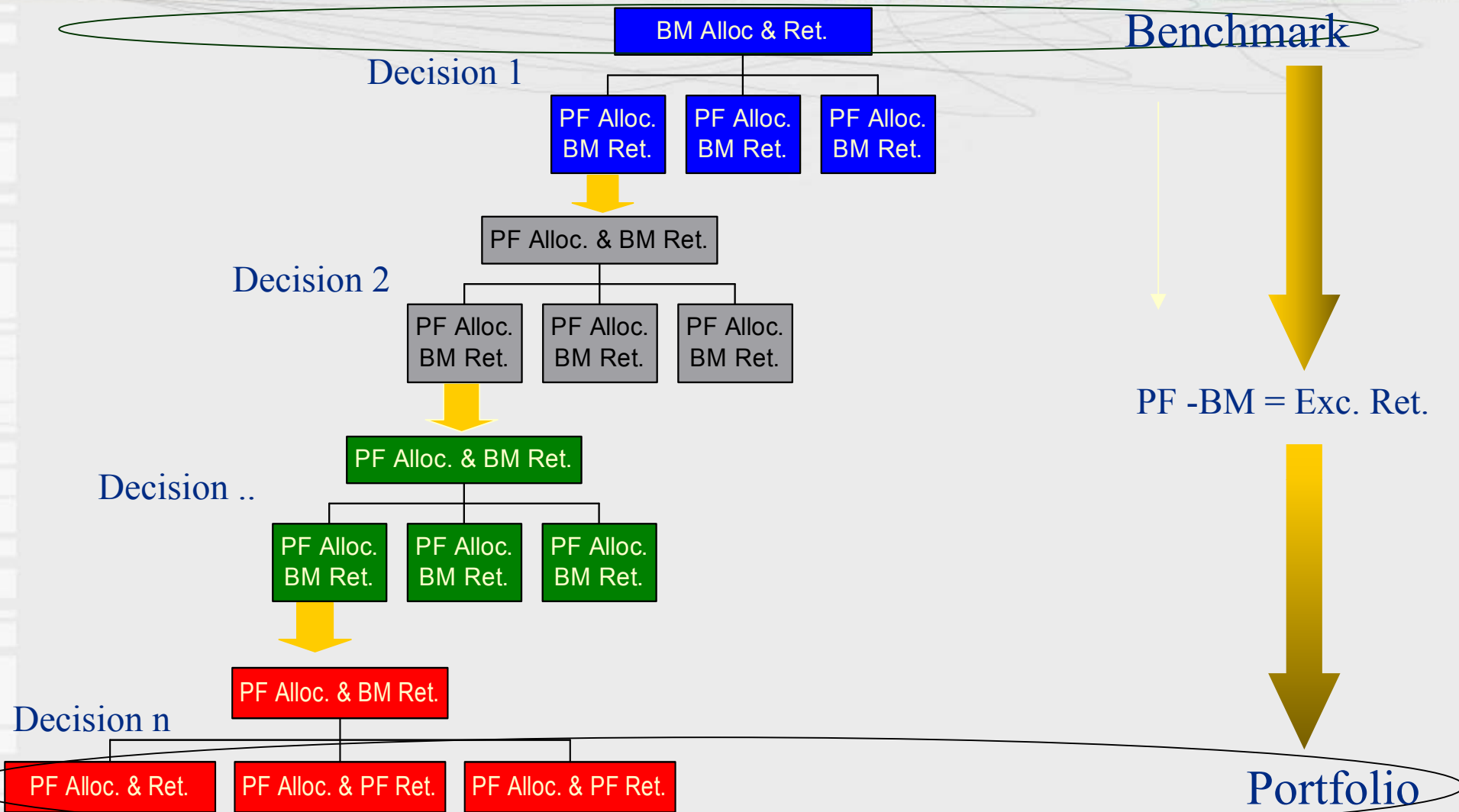
## Summary of IDP Model

- ▶ In the IDP all decisions are hierarchically determined
- ▶ The (excess) result of each decision can be measured
- ▶ By grouping decisions various analyses can be made
- ▶ All parts of the investment process can be modeled, including overlay programs, e.g. currency and duration.
- ▶ Different calculation / attribution methodologies can be applied to the various 'branches' of the investment decision 'tree'  
(to accommodate e.g. different asset classes).

## Attribution Methods

- ▶ **The IDP-MODEL does not dictate an attribution-method:**  
The desired attribution-method can be selected at any level
- ▶ **All multi-asset, multi-currency as well as multi-period attribution models are supported**
  - ▶ Brinson & Fachler, Brinson-Hood-Beebower (arithmetic)
  - ▶ Allan e.a (geometric)
  - ▶ Burnie, Knowles and Teder (Mixture arithmetic and geometric)
  - ▶ Karnosky & Singer
  - ▶ Fixed income models (Campisi, van Breukelen)
  - ▶ Using chain-linking or smoothing algorithms (e.g. Carino, Menchero, Mirabelli, Frongello/Wilshire, Davies, Laker)
  - ▶ And many other customized models

# Reasons for flexibility (1)



# Reasons for flexibility (2)

Decision 1

**Excess Return**

Benchmark

Allocation identified for decision k.

Unexplained Selection Effect

Decision k

Allocation Effect

Remaining Effect

Selection (including interaction) (= remaining effect) 'pushed down'.

Sum of all allocation effects + last selection effect = total excess result

Unexplained Selection Effect

Decision k+1

Allocation Effect

Remaining Effect

Decision n

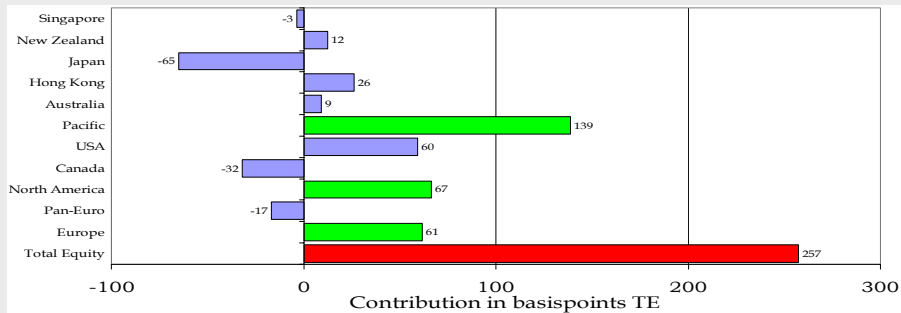
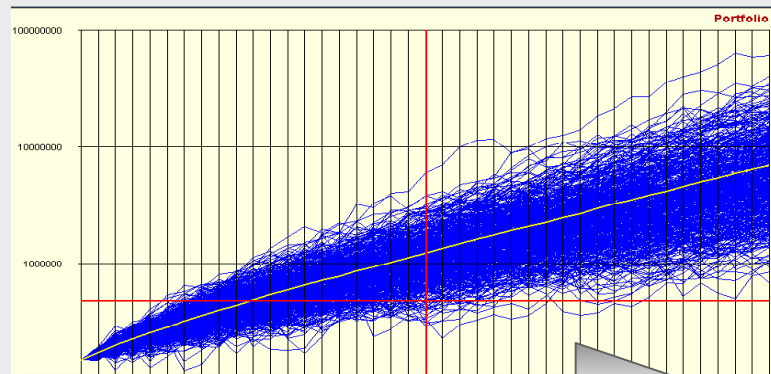
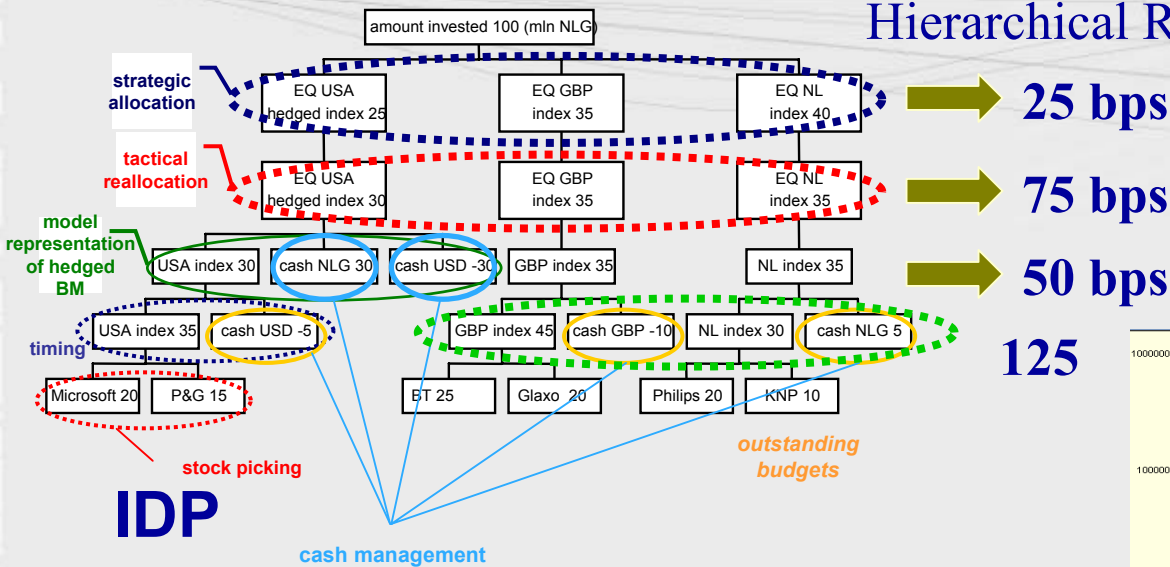
Portfolio

### **3. Ex-ante Risk Management with the IDP Model**

**(Decision Based Risk Contribution Analysis)**

# Ex-ante Risk Management

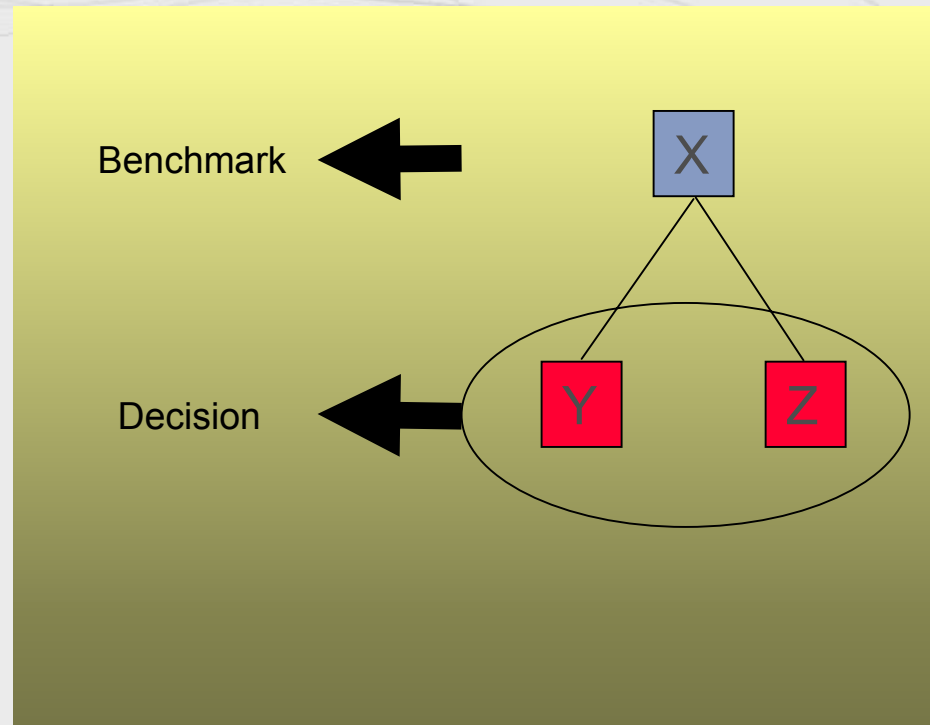
## Hierarchical Risk Budgeting



## RISK CONTRIBUTION REPORTING

# Evaluating a Decision

- X, Y and Z are products
- X is the decision's benchmark
- Market values sum up at t=0



## Added Value of a Decision:

$$mv_{t=1}(Y) + mv_{t=1}(Z) - mv_{t=1}(X) = \Delta_{t=1}^X$$

# Evaluating Two Decisions

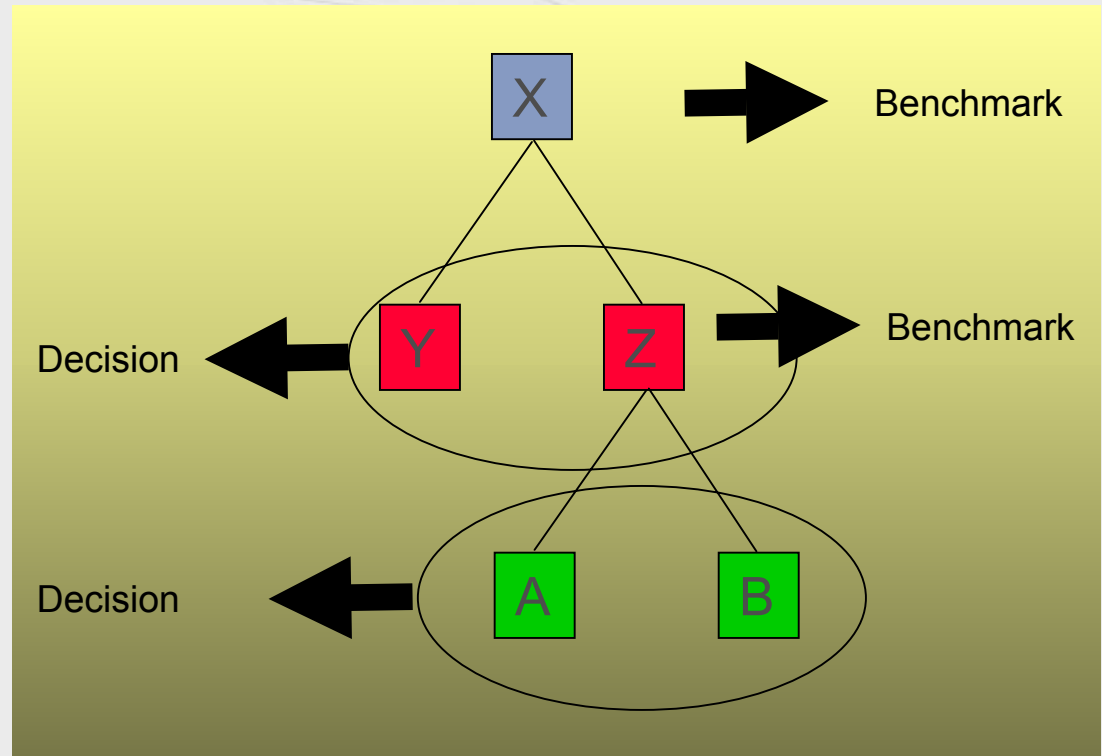
The Benchmark of a decision is (again) the investment one level higher.

Added values of decisions sum up.

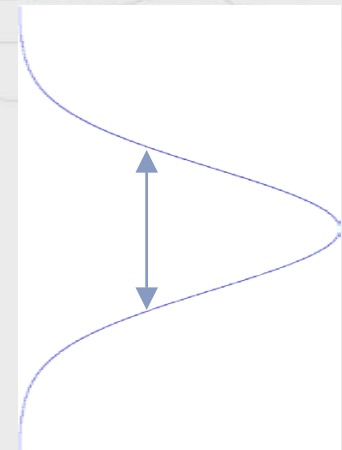
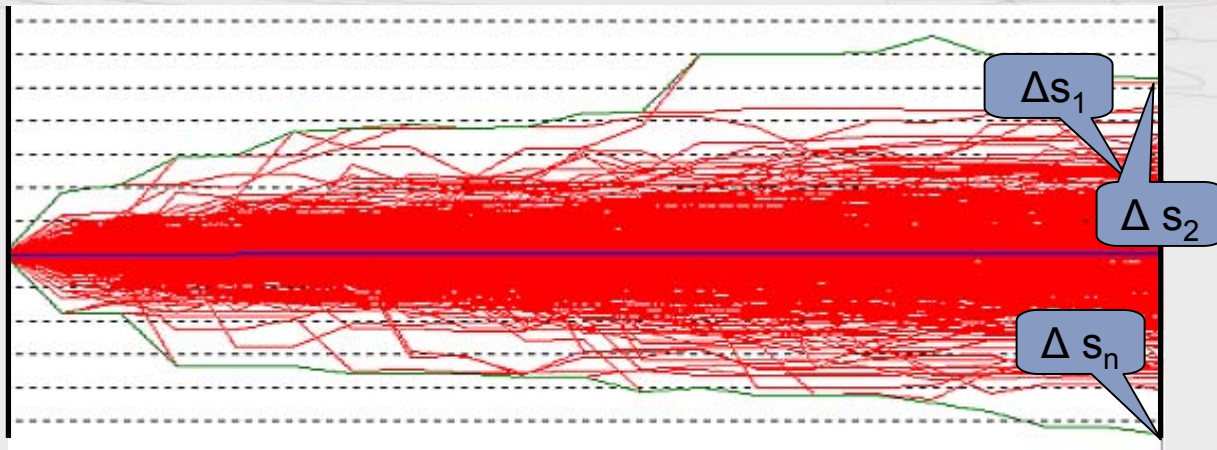
$$\Delta_t^X = mv_t(Y) + mv_t(Z) - mv_t(X)$$

$$\Delta_t^Z = mv_t(A) + mv_t(B) - mv_t(Z)$$

$$\Delta_t^X + \Delta_t^Z = mv_t(A) + mv_t(B) + mv_t(Y) - mv_t(X)$$



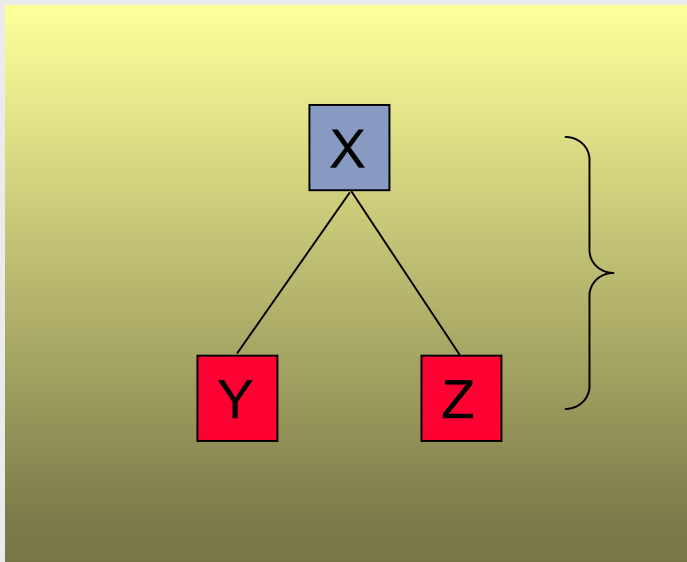
# Ex-ante: Relative Risk



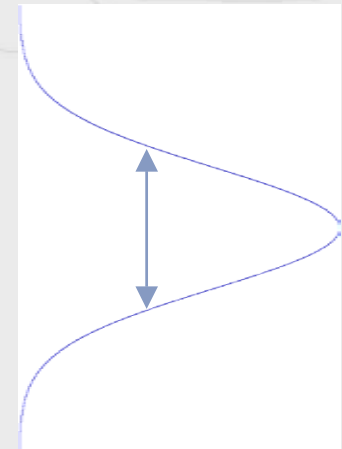
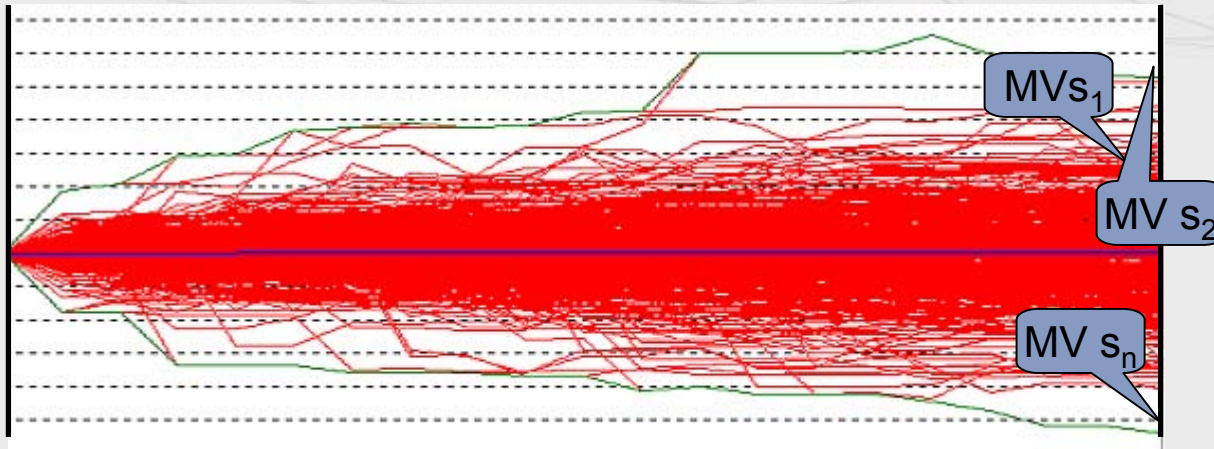
Define risk measures for the distribution, e.g. VaR or tracking error.

$$\sigma^2\left(\frac{\Delta_{st}^X}{mv_{t=0}(X)}\right) = \sigma^2(ER_{st}) = (te_t^X)^2$$

$$VaR(\Delta_{st}^X) = \dots$$



# Ex-ante: Absolute Risk



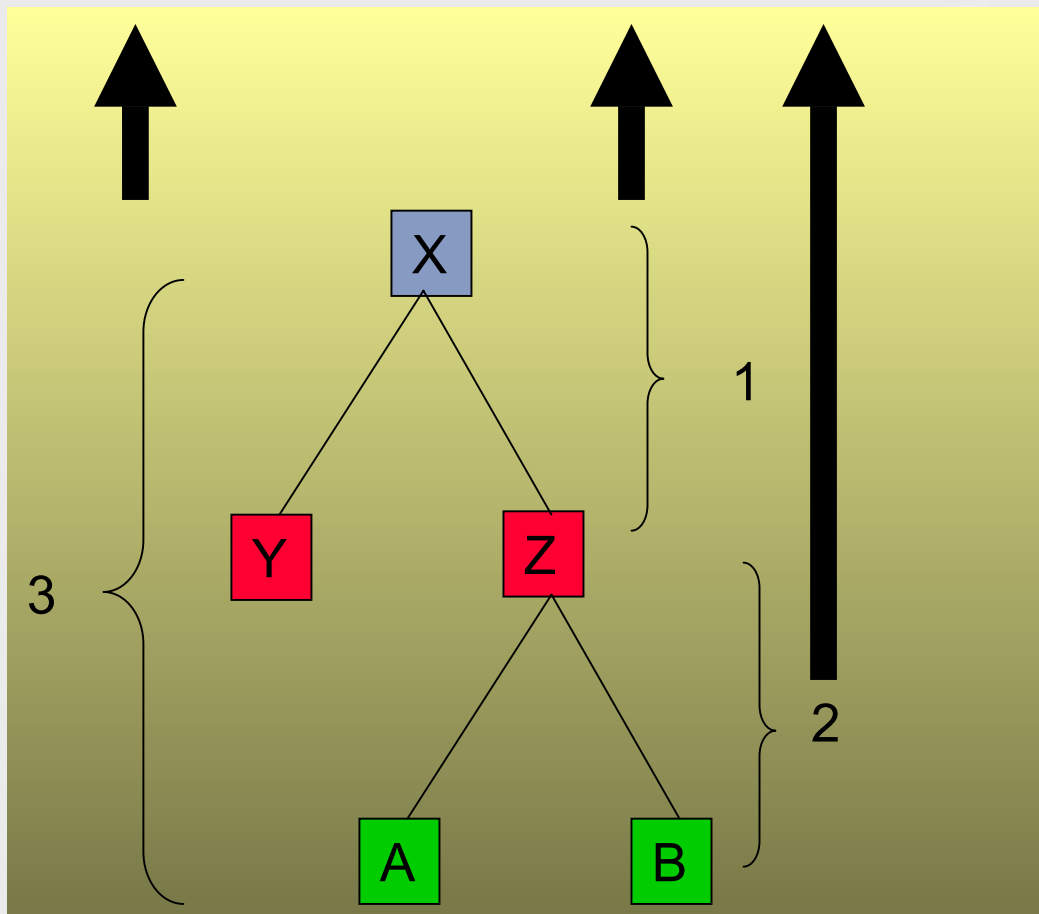
Volatility  $\sigma^2 \left( \frac{mv_{st}(X)}{mv_{t=0}(X)} \right)$

VaR  $VaR(mv(X))$

Note: A smaller tracking error does not necessarily mean less absolute risk.

# Ex-ante: TE of Two Decisions

$$(TE^X)^2 = \sigma^2 \left( \frac{\Delta^X + \Delta^Z}{mv_{t=0}(x)} \right)^2 = (te^X)^2 + \underbrace{\left( \frac{mv_{t=0}(z)}{mv_{t=0}(x)} \right)^2}_{1} (te^Z)^2 + 2 \cdot \frac{cov(\Delta^Y, \Delta^B)}{(mv_{t=0}(x))^2}$$



Negative Correlation is interesting for risk diversification.

# Ex-ante: TE Reports

**IDP Report**

Portfolio: EQ\_REGIO

Day: 19

IDP:

- PF Algemeen
  - Real Estate Group
    - Real Estate
      - RE Europe
      - RE Netherlands
      - RE US
    - TAA Group
      - Equity
        - EQ Emerging Ma
        - EQ Europe SC
        - EQ Europe ex UK
        - EQ Japan
        - EQ UK
        - EQ US
      - Fixed Income
        - FI EMD
        - FI EMU Credit
        - FI Emu Governr
        - FI US High Yield
        - FI US IG

TE1 Table | TE1 Graph | TE contr. table | TE contr. graph

Decision	TE	TE^2	%
PF Algemeen	0.00	0.0000	0%
Real Estate Group	0.00	0.0000	0%
Real Estate	0.00	0.0000	0%
RE Europe	0.00	0.0000	0%
RE Netherlands	0.00	0.0000	0%
RE US	0.00	0.0000	0%
TAA Group	0.16	0.0266	76%
Equity	0.10	0.0093	26%
EQ Emerging Markets	0.00	0.0000	0%
EQ Europe SC	0.00	0.0000	0%
EQ Europe ex UK	0.00	0.0000	0%
EQ Japan	0.00	0.0000	0%
EQ UK	0.00	0.0000	0%
EQ US	0.01	0.0000	0%
EQ US Large Cap	0.00	0.0000	0%
EQ US Small Cap	0.00	0.0000	0%
Fixed Income	0.00	0.0000	0%
FI EMD	0.00	0.0000	0%
FI EMU Credit	0.00	0.0000	0%
FI Emu Government	0.00	0.0000	0%
FI US High Yield	0.00	0.0000	0%
FI US IG	0.00	0.0000	0%
Correlation		-0.0008	-2%
<b>Total</b>	<b>0.19</b>	<b>0.0351</b>	<b>100%</b>

+ Zoom in   - Zoom out

Contribution Decisions

Contribution resulting from  
Correlation between Decisions

$TE^{PF}$  General

## Conclusions IDP-model

### ▶ The IDP-model determines:

- ▶ Which decisions are made
- ▶ The sequence in which the decisions are made
- ▶ How decisions need to be evaluated
- ▶ A suitable attribution-method for each decision

### ▶ Advantages of the IDP-model:

- ▶ *Optimal performance-evaluation and risk management; analyses follow the investment process, each individual decision is measured*
- ▶ *Flexible; applicable to any hierarchical investment process*
- ▶ *Transparent; investment policy and attribution-method are separated*

The background features a dark blue header with a yellow bar on the left containing the ORTEC logo. The right side of the header has a white line graph overlaid on a background of binary code (0s and 1s). Below the header, there are several thin, overlapping white lines that create a sense of motion or data flow. The main content area is white with a light blue grid pattern on the left side.

Appendix I

**Appendix I:**  
**Currency Overlay / Karnosky & Singer**

# Market IDP

Fund Benchmark (Liabilities)

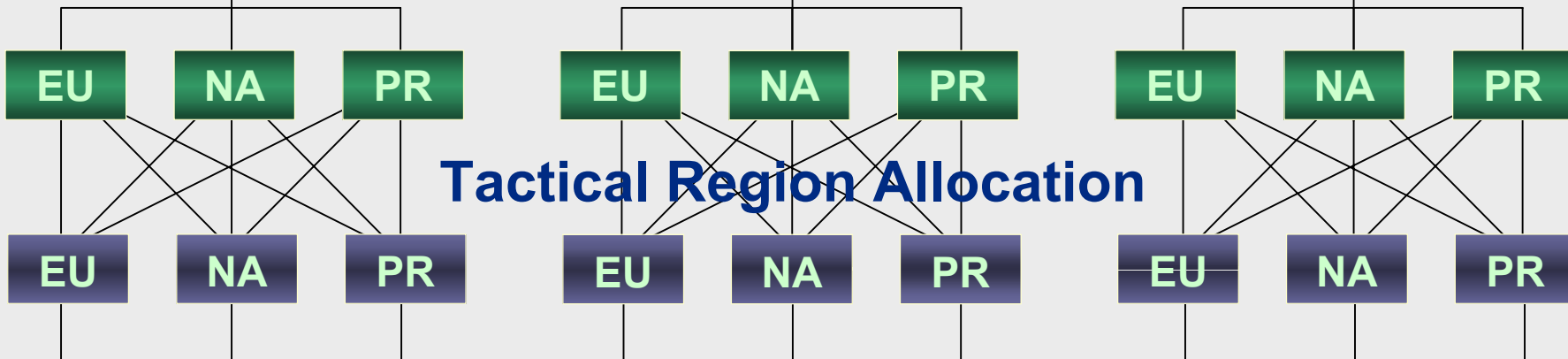
Strategic Asset Allocation



Tactical Asset Allocation



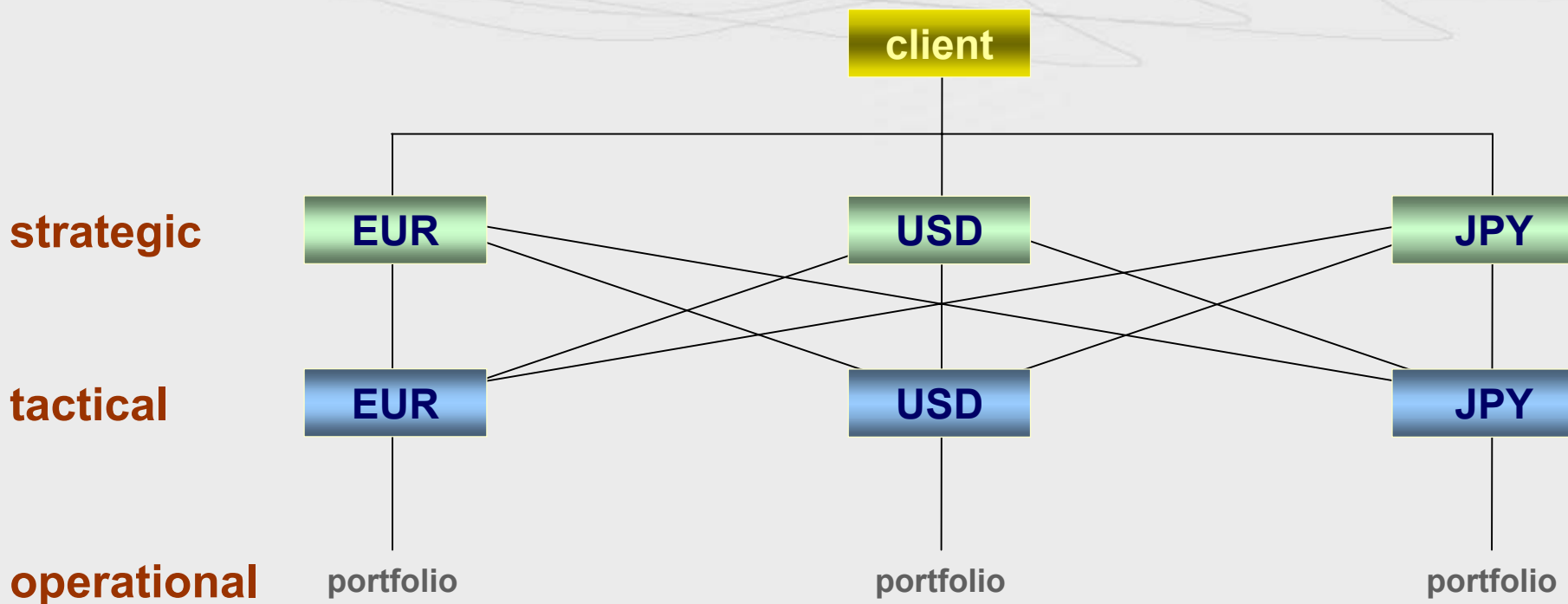
Tactical Region Allocation



portfolio portfolio portfolio portfolio portfolio portfolio portfolio portfolio portfolio

Operational Security Selections

▶ **Example IDP** *currency overlay*



# Sample Data

	market weights		returns		unhedged returns		hedged returns		returns	
	<i>benchmark</i>	<i>actual</i>	<i>benchmark</i>	<i>actual</i>	<i>benchmark</i>	<i>actual</i>	<i>benchmark</i>	<i>actual</i>	<i>benchmark</i>	<i>actual</i>
<b>equity</b>	45.00%	40.00%	5.44%	6.00%					5.82%	6.02%
Europe	20.00%	15.00%	6.00%	6.50%	6.00%	6.50%	6.00%	6.50%	6.00%	6.50%
North America	15.00%	20.00%	7.00%	6.50%	6.50%	6.00%	6.25%	5.60%	6.38%	5.90%
Pacific	10.00%	5.00%	2.00%	2.50%	4.50%	5.00%	4.75%	5.15%	4.63%	5.04%
<b>fixed income</b>	52.50%	55.00%	3.26%	4.50%					3.15%	4.54%
Europe	30.00%	20.00%	2.00%	2.25%	2.00%	2.25%	2.00%	2.25%	2.00%	2.25%
North America	20.00%	27.50%	5.00%	6.20%	4.50%	5.70%	4.25%	5.30%	4.38%	5.60%
Pacific	2.50%	7.50%	4.50%	4.25%	7.00%	6.75%	7.25%	6.90%	7.13%	6.79%
<b>cash</b>	2.50%	5.00%	4.25%	4.13%					4.25%	4.33%
Europe	2.50%	1.50%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%	4.25%
North America	0.00%	2.50%	5.00%	5.00%	4.50%	4.50%	4.25%	4.10%	4.38%	4.40%
Pacific	0.00%	1.00%	1.50%	1.75%	4.00%	4.25%	4.25%	4.40%	4.13%	4.29%
<b>ccy-overlay</b>	100.00%	100.00%			0.07%	0.07%	0.04%	-0.07%	0.03%	0.13%
EUR	76.25%	52.38%			0.00%		0.00%	0.00%	0.00%	0.00%
USD	17.50%	37.50%			-0.50%		-0.75%	-0.90%	-0.63%	-0.60%
JPY	6.25%	10.13%			2.50%		2.75%	2.65%	2.63%	2.54%

<b>hedge ratios</b>	<i>benchmark</i>	<i>actual</i>
EUR	0%	0%
USD	50%	25%
JPY	50%	25%

# Brinson & Fachler

asset class	weights			returns			allocation	selection
	actual	plan	excess	actual	plan	excess		
equity	40.00%	45.00%	-5.00%	6.02%	5.82%	0.20%	-0.07%	0.08%
fixed income	55.00%	52.50%	2.50%	4.54%	3.15%	1.39%	-0.03%	0.77%
cash	5.00%	2.50%	2.50%	4.33%	4.25%	0.08%	0.00%	0.00%
	100.00%	100.00%	0.00%	5.12%	4.38%	0.74%	-0.11%	0.85%

region	weights			returns			allocation	selection
	actual	plan	excess	actual	plan	excess		
Europe	37.50%	44.44%	-6.94%	6.50%	6.00%	0.50%	-0.01%	0.19%
North America	50.00%	33.33%	16.67%	5.90%	6.38%	-0.48%	0.09%	-0.24%
Pacific	12.50%	22.22%	-9.72%	5.04%	4.63%	0.41%	0.12%	0.05%
<b>equity</b>	<b>100.00%</b>	<b>100.00%</b>	<b>0.00%</b>	<b>6.02%</b>	<b>5.82%</b>	<b>0.20%</b>	<b>0.20%</b>	<b>0.00%</b>

region	weights			returns			allocation	selection
	actual	plan	excess	actual	plan	excess		
Europe	36.36%	57.14%	-20.78%	2.25%	2.00%	0.25%	0.24%	0.09%
North America	50.00%	38.10%	11.90%	5.60%	4.38%	1.23%	0.15%	0.61%
Pacific	13.64%	4.76%	8.87%	6.79%	7.13%	-0.34%	0.35%	-0.05%
<b>fixed income</b>	<b>100.00%</b>	<b>100.00%</b>	<b>0.00%</b>	<b>4.54%</b>	<b>3.15%</b>	<b>1.39%</b>	<b>0.74%</b>	<b>0.66%</b>

region	weights			returns			allocation	selection
	actual	plan	excess	actual	plan	excess		
Europe	30.00%	100.00%	-70.00%	4.25%	4.25%	0.00%	0.00%	0.00%
North America	50.00%	0.00%	50.00%	4.40%	4.38%	0.03%	0.06%	0.01%
Pacific	20.00%	0.00%	20.00%	4.29%	4.13%	0.16%	-0.03%	0.03%
<b>cash</b>	<b>100.00%</b>	<b>100.00%</b>	<b>0.00%</b>	<b>4.33%</b>	<b>4.25%</b>	<b>0.08%</b>	<b>0.04%</b>	<b>0.04%</b>

<b>TOTAL</b>	<b>0.49%</b>	<b>0.36%</b>	<b>0.85%</b>
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▶ **Brinson & Fachler** *summary*

<b>plan return</b>	<b>4.38%</b>
<b>asset class allocation</b>	<b>-0.11%</b>
<b>region allocation</b>	<b>0.49%</b>
<b>security selection</b>	<b>0.36%</b>
<b><i>total</i></b>	<b><i>0.74%</i></b>
<b>actual return</b>	<b>5.12%</b>

# Karnosky & Singer

asset class	market weights			local risk premia			allocation	selection
	actual	plan	excess	actual	plan	excess		
equity	40.00%	45.00%	-5.00%	1.72%	1.56%	0.16%	-0.07%	0.07%
fixed income	55.00%	52.50%	2.50%	0.25%	-1.14%	1.39%	-0.03%	0.76%
cash	5.00%	2.50%	2.50%	0.05%	0.00%	0.05%	0.00%	0.00%
	100.00%	100.00%	0.00%	0.83%	0.10%	0.73%	-0.11%	0.83%

region	market weights			local risk premia			allocation	selection
	actual	plan	excess	actual	plan	excess		
Europe	37.50%	44.44%	-6.94%	2.25%	1.75%	0.50%	-0.01%	0.19%
North America	50.00%	33.33%	16.67%	1.50%	2.00%	-0.50%	0.07%	-0.25%
Pacific	12.50%	22.22%	-9.72%	1.00%	0.50%	0.50%	0.10%	0.06%
<b>equity</b>	<b>100.00%</b>	<b>100.00%</b>	<b>0.00%</b>	<b>1.72%</b>	<b>1.56%</b>	<b>0.16%</b>	<b>0.16%</b>	<b>0.00%</b>

region	market weights			local risk premia			allocation	selection
	actual	plan	excess	actual	plan	excess		
Europe	36.36%	57.14%	-20.78%	-2.00%	-2.25%	0.25%	0.23%	0.09%
North America	50.00%	38.10%	11.90%	1.20%	0.00%	1.20%	0.14%	0.60%
Pacific	13.64%	4.76%	8.87%	2.75%	3.00%	-0.25%	0.37%	-0.03%
<b>fixed income</b>	<b>100.00%</b>	<b>100.00%</b>	<b>0.00%</b>	<b>0.25%</b>	<b>-1.14%</b>	<b>1.39%</b>	<b>0.73%</b>	<b>0.66%</b>

region	market weights			local risk premia			allocation	selection
	actual	plan	excess	actual	plan	excess		
Europe	30.00%	100.00%	-70.00%	0.00%	0.00%	0.00%	0.00%	0.00%
North America	50.00%	0.00%	50.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Pacific	20.00%	0.00%	20.00%	0.25%	0.00%	0.25%	0.00%	0.05%
<b>cash</b>	<b>100.00%</b>	<b>100.00%</b>	<b>0.00%</b>	<b>0.05%</b>	<b>0.00%</b>	<b>0.05%</b>	<b>0.00%</b>	<b>0.05%</b>

<b>TOTAL</b>	<b>0.47%</b>	<b>0.36%</b>	<b>0.83%</b>
--------------	--------------	--------------	--------------

currency	currency weights			returns			allocation	selection
	actual	plan	excess	actual	plan	excess		
EUR	52.38%	76.25%	-23.88%	4.21%	4.25%	-0.04%	0.01%	-0.02%
USD	37.50%	17.50%	20.00%	4.50%	4.50%	0.00%	0.04%	0.00%
JPY	10.13%	6.25%	3.88%	4.00%	4.00%	0.00%	-0.01%	0.00%
<b>total</b>	<b>100.00%</b>	<b>100.00%</b>	<b>0.00%</b>	<b>4.30%</b>	<b>4.28%</b>	<b>0.02%</b>	<b>0.04%</b>	<b>-0.02%</b>

<b>0.02%</b>
--------------

## ▶ Karnosky & Singer *summary*

<b>plan return</b>	<b>4.38%</b>
<b>asset class allocation</b>	<b>-0.11%</b>
<b>region allocation</b>	<b>0.47%</b>
<b>security selection</b>	<b>0.36%</b>
<b>currency (exposure) allocation</b>	<b>0.04%</b>
<b>operational currency hedging</b>	<b>-0.02%</b>
<b><i>total</i></b>	<b><i>0.74%</i></b>
<b>actual return</b>	<b>5.12%</b>

IDP attribution analysis market decisions

-0.11

0.47

0.36

	Client									Total
<u>Asset Allocation:</u>										
<b>SAA</b> →	<b>EQ</b>			<b>FI</b>			<b>CA</b>			
	PB: 5,555.25			6,481.13			308.63			12,345.00
	gain: 86.42			(74.07)			0.00			12.35
	return: 1.56%			-1.14%			0.00%			0.10%
<b>TAA</b> →	<b>EQ</b>			<b>FI</b>			<b>CA</b>			
	4,938.00			6,789.75			617.25			12,345.00
	76.81			(77.60)			0.00			(0.78)
	1.56%			-1.14%			0.00%			-0.01%
<u>Region Allocation:</u>										
<b>SRA</b> →	<b>EU</b>	<b>NA</b>	<b>PR</b>	<b>EU</b>	<b>NA</b>	<b>PR</b>	<b>EU</b>	<b>NA</b>	<b>PR</b>	
	2,194.67	1,646.00	1,097.33	3,879.86	2,586.57	323.32	617.25	0.00	0.00	12,345.00
	38.41	32.92	5.49	(87.30)	0.00	9.70	0.00	0.00	0.00	(0.78)
	1.75%	2.00%	0.50%	-2.25%	0.00%	3.00%	0.00%	0.00%	0.00%	-0.01%
<b>TRA</b> →	<b>EU</b>	<b>NA</b>	<b>PR</b>	<b>EU</b>	<b>NA</b>	<b>PR</b>	<b>EU</b>	<b>NA</b>	<b>PR</b>	
	1,851.75	2,469.00	617.25	2,469.00	3,394.88	925.88	185.18	308.63	123.45	12,345.00
	32.41	49.38	3.09	(55.55)	0.00	27.78	0.00	0.00	0.00	57.10
	1.75%	2.00%	0.50%	-2.25%	0.00%	3.00%	0.00%	0.00%	0.00%	0.46%
<u>Stock Picking:</u>										
<b>PF</b> →	<b>EU</b>	<b>NA</b>	<b>PR</b>	<b>EU</b>	<b>NA</b>	<b>PR</b>	<b>EU</b>	<b>NA</b>	<b>PR</b>	
	1,851.75	2,469.00	617.25	2,469.00	3,394.88	925.88	185.18	308.63	123.45	12,345.00
	41.66	37.04	6.17	(49.38)	40.74	25.46	0.00	0.00	0.31	102.00
	2.25%	1.50%	1.00%	-2.00%	1.20%	2.75%	0.00%	0.00%	0.25%	0.83%

IDP attribution analysis currency decisions

	Client			Total	
<i>currency selection excl. bets:</i>	EUR	USD	JPY		
<b>PB:</b>	9,413.06	2,160.38	771.56	12,345.00	
<b>gain:</b>	400.06	97.22	30.86	528.13	
<b>return:</b>	4.25%	4.50%	4.00%	4.28%	
	EUR	USD	JPY		
<b>PB:</b>	7,947.09	3,240.56	1,157.34	12,345.00	0.01
<b>gain:</b>	337.75	145.83	46.29	529.87	
<b>return:</b>	4.25%	4.50%	4.00%	4.29%	
<i>currency selection bets:</i>	EUR	USD	JPY		
<b>PB:</b>	6,465.69	4,629.38	1,249.93	12,345.00	0.03
<b>gain:</b>	274.79	208.32	50.00	533.11	
<b>return:</b>	4.25%	4.50%	4.00%	4.32%	
<i>operational currency hedging:</i>	EUR	USD	JPY		
<b>PB:</b>	6,465.69	4,629.38	1,249.93	12,345.00	-0.02
<b>gain:</b>	272.06	208.32	50.00	530.38	
<b>return:</b>	4.21%	4.50%	4.00%	4.30%	

0.04

PF →

▶ **IDP** *summary*

	<i>gain</i>	<i>return</i>
<b>plan</b>	<b>540.48</b>	<b>4.38%</b>
<b><u>MARKET DECISIONS</u></b>		
<b>asset allocation</b>	<b>(13.13)</b>	<b>-0.11%</b>
<b>region allocation</b>	<b>57.88</b>	<b>0.47%</b>
<b>stock picking</b>	<b>44.90</b>	<b>0.36%</b>
<b><i>total market</i></b>	<b>89.66</b>	<b>0.73%</b>
<b><u>CURRENCY DECISIONS</u></b>		
<b>currency selection excl. bets</b>	<b>1.74</b>	<b>0.01%</b>
<b>currency selection due to bets</b>	<b>3.24</b>	<b>0.03%</b>
<b>operational hedging</b>	<b>(2.73)</b>	<b>-0.02%</b>
<b><i>total currency</i></b>	<b>2.25</b>	<b>0.02%</b>
<b>ACTUAL</b>	<b>632.38</b>	<b>5.12%</b>
<b>EXCESS</b>	<b>91.90</b>	<b>0.74%</b>



Appendix II

**Appendix II:**  
**Hierarchy of Decisions**

# Decision Order

Portfolio fixed income

Region	Sector	Weight	Return
Eurozone	Government	37.5%	4.00%
Non-Eurozone	Government	20.0%	-1.00%
Eurozone	Corporate	30.0%	3.00%
Non-Eurozone	Corporate	12.5%	2.00%
<b>Total</b>		<b>100.0%</b>	<b>2.45%</b>

Benchmark fixed income

Region	Sector	Weight	Return
Eurozone	Government	45.0%	5.00%
Non-Eurozone	Government	12.0%	0.00%
Eurozone	Corporate	20.0%	2.00%
Non-Eurozone	Corporate	23.0%	1.00%
<b>Total</b>		<b>100.0%</b>	<b>2.88%</b>

Region	Weight	Return
Eurozone	67.5%	3.56%
Non-Eurozone	32.5%	0.15%
<b>Total</b>	<b>100.0%</b>	<b>2.45%</b>
Sector	Weight	Return
Government	57.5%	2.26%
Corporate	42.5%	2.71%
<b>Total</b>	<b>100.0%</b>	<b>2.45%</b>

Region	Weight	Return
Eurozone	65.0%	4.08%
Non-Eurozone	35.0%	0.66%
<b>Total</b>	<b>100.0%</b>	<b>2.88%</b>
Sector	Weight	Return
Government	57.0%	3.95%
Corporate	43.0%	1.47%
<b>Total</b>	<b>100.0%</b>	<b>2.88%</b>

Excess result = 2.45% - 2.88% = -0.43%

# Order: Region, Sector, Stock

Option A: attribution-analysis to regions⇒

per region attribution-analysis to sectors

Region	Return PF	Weight PF	Return BM	Weight BM	Allocation	Selection	Total
Eurozone	3.56%	67.5%	4.08%	65.0%	0.03%	-0.35%	-0.32%
Non-Eurozone	0.15%	32.5%	0.66%	35.0%	0.06%	-0.16%	-0.11%
<b>Total</b>	<b>2.45%</b>	<b>100.0%</b>	<b>2.88%</b>	<b>100.0%</b>	<b>0.09%</b>	<b>-0.52%</b>	<b>-0.43%</b>

region allocation

Sector	Return PF	Weight PF	Return BM	Weight BM	Allocation	Selection	Total
Government	4.00%	55.6%	5.00%	69.2%	-0.13%	-0.56%	-0.68%
Corporate	3.00%	44.4%	2.00%	30.8%	-0.28%	0.44%	0.16%
<b>Eurozone</b>	<b>3.56%</b>	<b>100.0%</b>	<b>4.08%</b>	<b>100.0%</b>	<b>-0.41%</b>	<b>-0.11%</b>	<b>-0.52%</b>
Government	-1.00%	61.5%	0.00%	34.3%	-0.18%	-0.62%	-0.79%
Corporate	2.00%	38.5%	1.00%	65.7%	-0.09%	0.38%	0.29%
<b>Non-Eurozone</b>	<b>0.15%</b>	<b>100.0%</b>	<b>0.66%</b>	<b>100.0%</b>	<b>-0.27%</b>	<b>-0.23%</b>	<b>-0.50%</b>
<b>Total</b>					<b>-0.37%</b>	<b>-0.15%</b>	<b>-0.52%</b>

sector-allocation

stock picking

# Order: Sector, Region, Stock

Option B: attribution-analysis by sector

⇒ per sector attribution-analysis to regions

Sector	Return PF	Weight PF	Return BM	Weight BM	Allocation	Selection	Total
Government	2.26%	57.5%	3.95%	57.0%	0.01%	-0.97%	-0.96%
Corporate	2.71%	42.5%	1.47%	43.0%	0.01%	0.53%	0.53%
<b>Total</b>	<b>2.45%</b>	<b>100.0%</b>	<b>2.88%</b>	<b>100.0%</b>	<b>0.01%</b>	<b>-0.44%</b>	<b>-0.43%</b>

sector-allocation

Region	Return PF	Weight PF	Return BM	Weight BM	Allocation	Selection	Total
Eurozone	4.00%	65.2%	5.00%	78.9%	-0.14%	-0.65%	-0.80%
Non-Eurozone	-1.00%	34.8%	0.00%	21.1%	-0.54%	-0.35%	-0.89%
<b>Government</b>	<b>2.26%</b>	<b>100.0%</b>	<b>3.95%</b>	<b>100.0%</b>	<b>-0.69%</b>	<b>-1.00%</b>	<b>-1.69%</b>
Eurozone	3.00%	70.6%	2.00%	46.5%	0.13%	0.71%	0.83%
Non-Eurozone	2.00%	29.4%	1.00%	53.5%	0.11%	0.29%	0.41%
<b>Corporate</b>	<b>2.71%</b>	<b>100.0%</b>	<b>1.47%</b>	<b>100.0%</b>	<b>0.24%</b>	<b>1.00%</b>	<b>1.24%</b>
<b>Total</b>	<b>2.45%</b>		<b>2.88%</b>		<b>-0.29%</b>	<b>-0.15%</b>	<b>-0.44%</b>

region allocation

stock picking

# Orders Compared

Option A: Region - Sector

Option B: Sector - Region

	Contribution
<b>Regional allocation</b>	<b>0.09%</b>
<b>Sector allocation</b>	<b>-0.37%</b>
Eurozone	-0.41%
Non-Eurozone	-0.27%
<b>Stock picking</b>	<b>-0.15%</b>
Eurozone	-0.11%
Non-Eurozone	-0.23%
<b>Total</b>	<b>-0.43%</b>

	Contribution
<b>Sector allocation</b>	<b>0.01%</b>
<b>Regional allocation</b>	<b>-0.29%</b>
Government	-0.69%
Corporate	0.24%
<b>Stock picking</b>	<b>-0.15%</b>
Government	-1.00%
Corporate	1.00%
<b>Total</b>	<b>-0.43%</b>

*The attribution model should reflect the sequence of decisions in the investment process!*



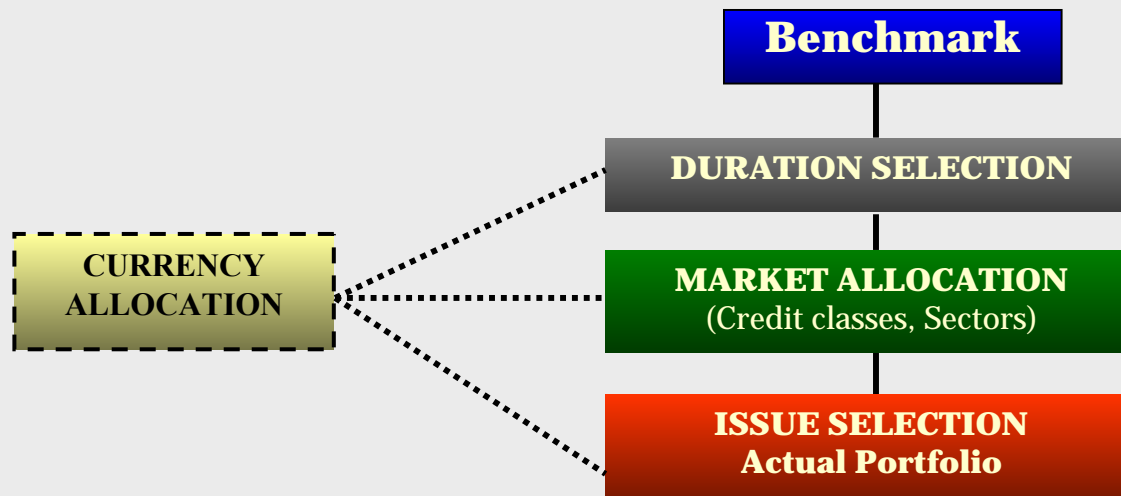
Appendix III

**Appendix III:  
Fixed Income Attribution**

## Fixed Income Investment Process

In a Fixed-Income process, investment decisions are generally made regarding:

- Duration
- Segments like Credit classes, sectors, etc.
- Issue selection
- Currency



## Fixed Income Attribution

- ▶ Attribution = Analysis of investment decisions
  - ▶ Allocation decisions based on market-value weights (e.g. Brinson Fachler based on duration buckets / credit classes)
  - ▶ Allocation decisions based on positioning on yield curve(s) (e.g. van Breukelen (Robeco))
- ▶ Both type of decision analyses can be regarded as using reference (or notional) portfolios

## Fixed Income Example

### Example Method: (Van Breukelen)

Local return of an issue:

$$LR = \text{Risk Free Rate} + \text{Duration} \times (-\Delta \text{Yield})$$

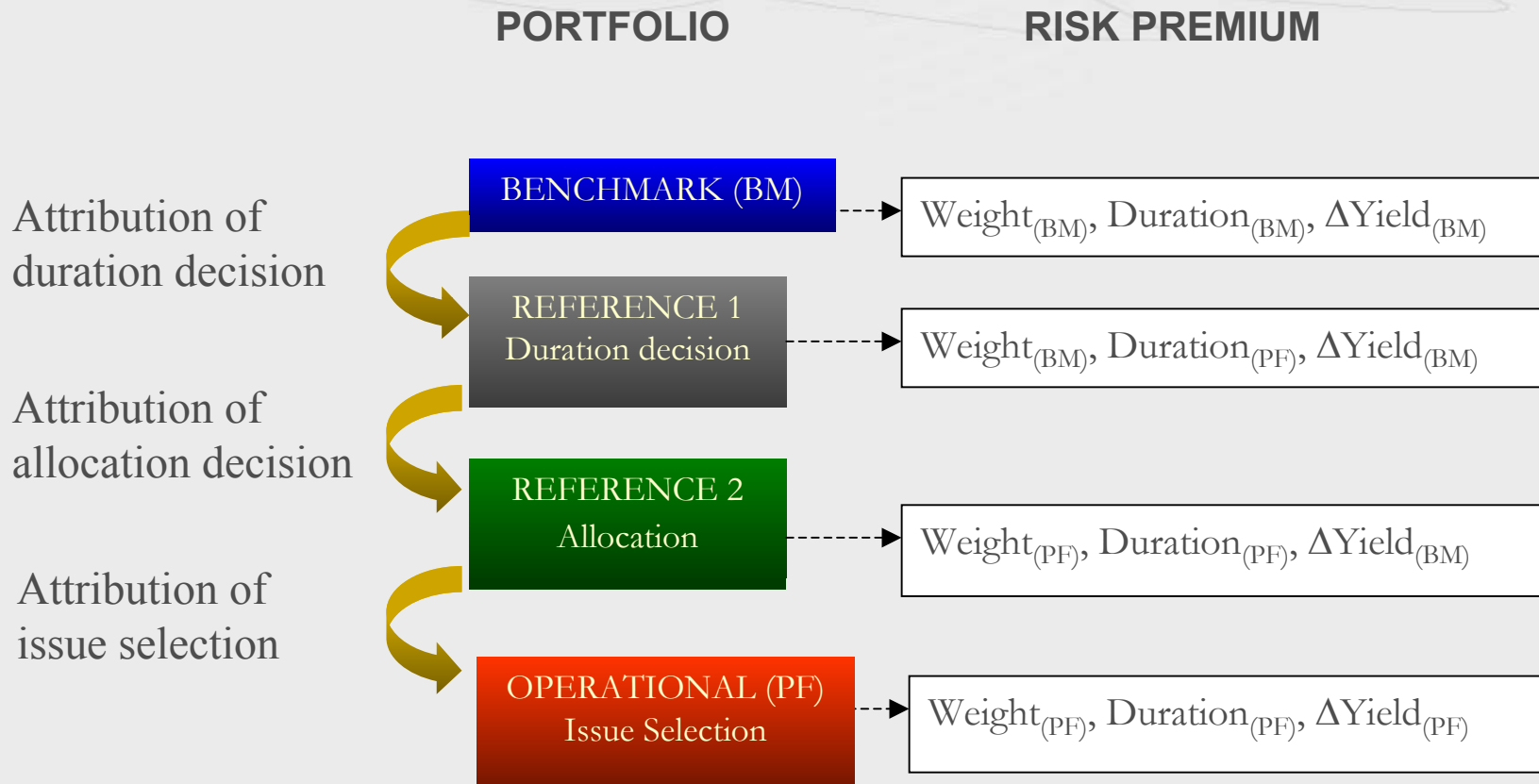
Total return of a portfolio:

$$\begin{aligned} TR &= \sum \text{Weight} \times (LR + \text{Currency Return}) \\ &= \sum \text{Weight} \times (LR - \text{Risk Free Rate}) + \sum \text{Weight} \times (\text{Risk Free Rate} - \text{Currency Return}) \end{aligned}$$

Total risk premium of a portfolio:

$$RP = \sum \text{Weight} \times \text{Duration} \times (-\Delta \text{Yield})$$

# Construction of Reference Portfolios



# Fixed Income Attribution

The risk premium of the portfolios:

Benchmark	=	$W_{BM} \times D_{BM} \times (-\Delta Y_{BM})$
Reference Portfolio 1	=	$W_{BM} \times \left( D_{BM} \times \frac{D_{PFtot}}{D_{BMtot}} \right) \times (-\Delta Y_{BM})$
Reference Portfolio 2	=	$W_{PF} \times D_{PF} \times (-\Delta Y_{BM})$
Operational Portfolio	=	$W_{PF} \times D_{PF} \times (-\Delta Y_{PF})$

- The benchmark and the reference portfolio 1 differ only in the *duration*.
- Therefore the attribution of the *duration* decision is the difference between the risk premium of the benchmark and reference portfolio 1.
- The reference portfolio 1 and 2 differ only in the *weightings*. Therefore the attribution of the *allocation* is the difference between the risk premium of the reference portfolio 1 and 2.
- The reference portfolio 2 and the actual portfolio differ only in the *individual issues*. Therefore the attribution of the *issue selection* is the difference between the risk premium of the reference portfolio 2 and the actual portfolio.

## Fixed Income Attribution

The attribution of the currency decision is the difference between the currency result of the benchmark and the actual portfolio:

$$\Sigma \text{Weight}_{PF} \times (\text{Risk Free Rate} - \text{Currency Return}) - \Sigma \text{Weight}_{BM} \times (\text{Risk Free Rate} - \text{Currency Return})$$

# Sample Report: FI Attribution

	Return
Actual Portfolio	2.691%
Benchmark	-0.661%
<b>Excess</b>	<b>3.352%</b>

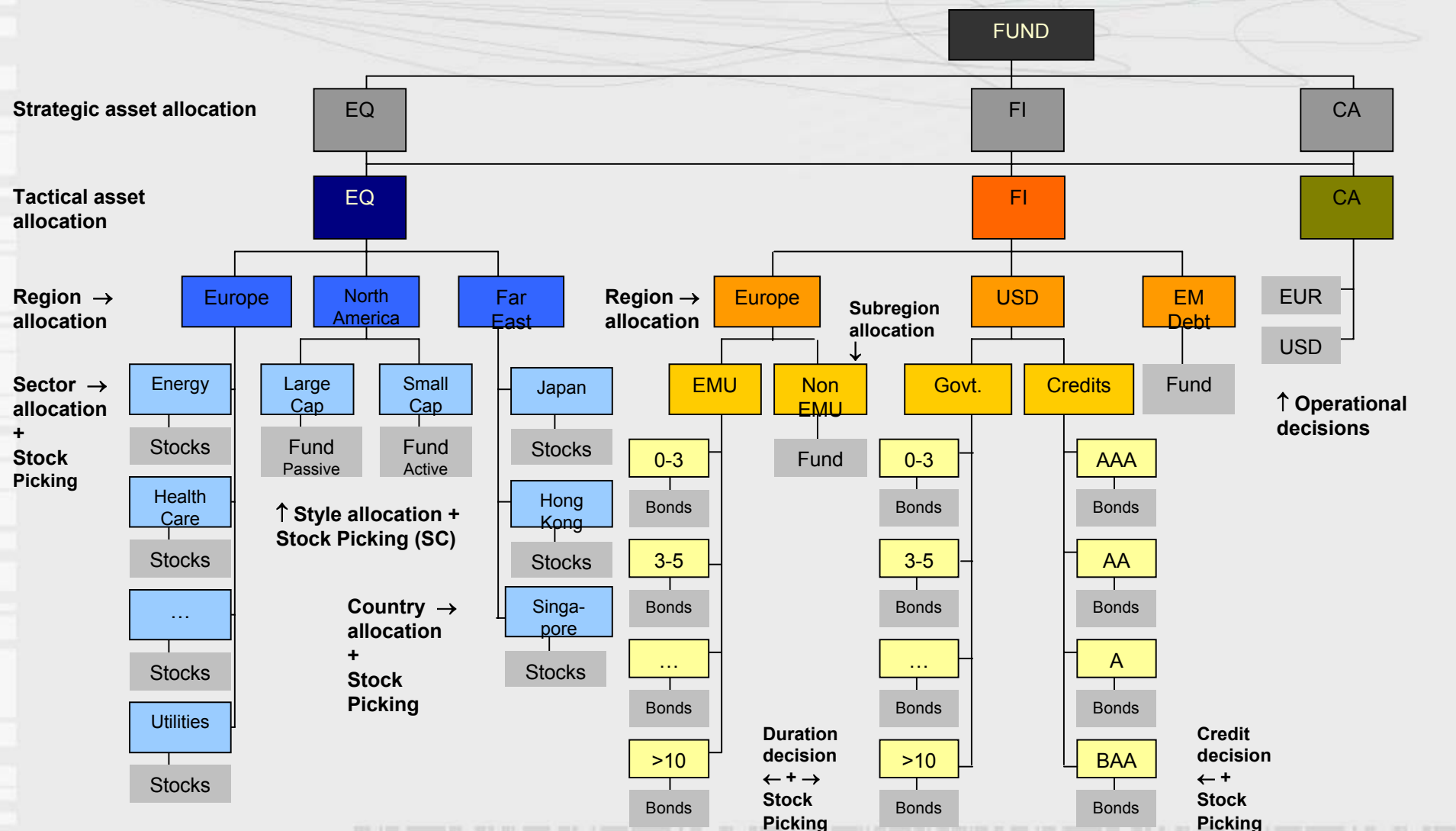
Attribution to Decisions	Actual	Benchmark	Actual Return	Benchmark Return	Excess Return
Duration Selection	Reference Portfolio 1	Benchmark	0.066%	-0.133%	<b>0.199%</b>
Asset Allocation	Reference Portfolio 2	Reference Portfolio 1	2.171%	0.066%	<b>2.105%</b>
Issue Selection	Actual Portfolio	Reference Portfolio 2	3.119%	2.171%	<b>0.948%</b>
Currency Allocation	Actual Portfolio	Benchmark	-0.428%	-0.528%	<b>0.101%</b>
<b>Total</b>			<b>2.691%</b>	<b>-0.661%</b>	<b>3.352%</b>



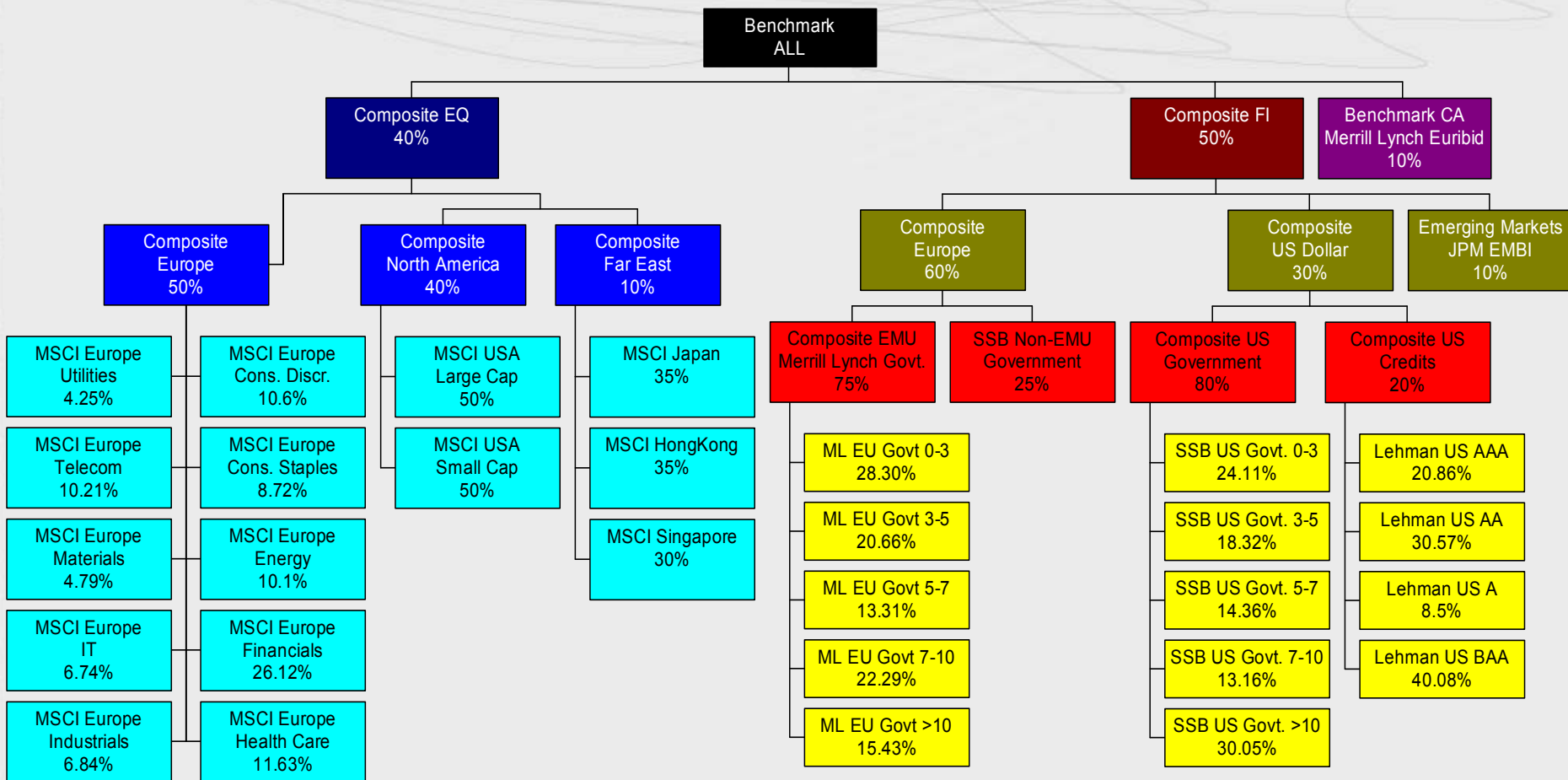
Appendix IV

**Appendix IV:**  
**Sample IDPs and Reports**

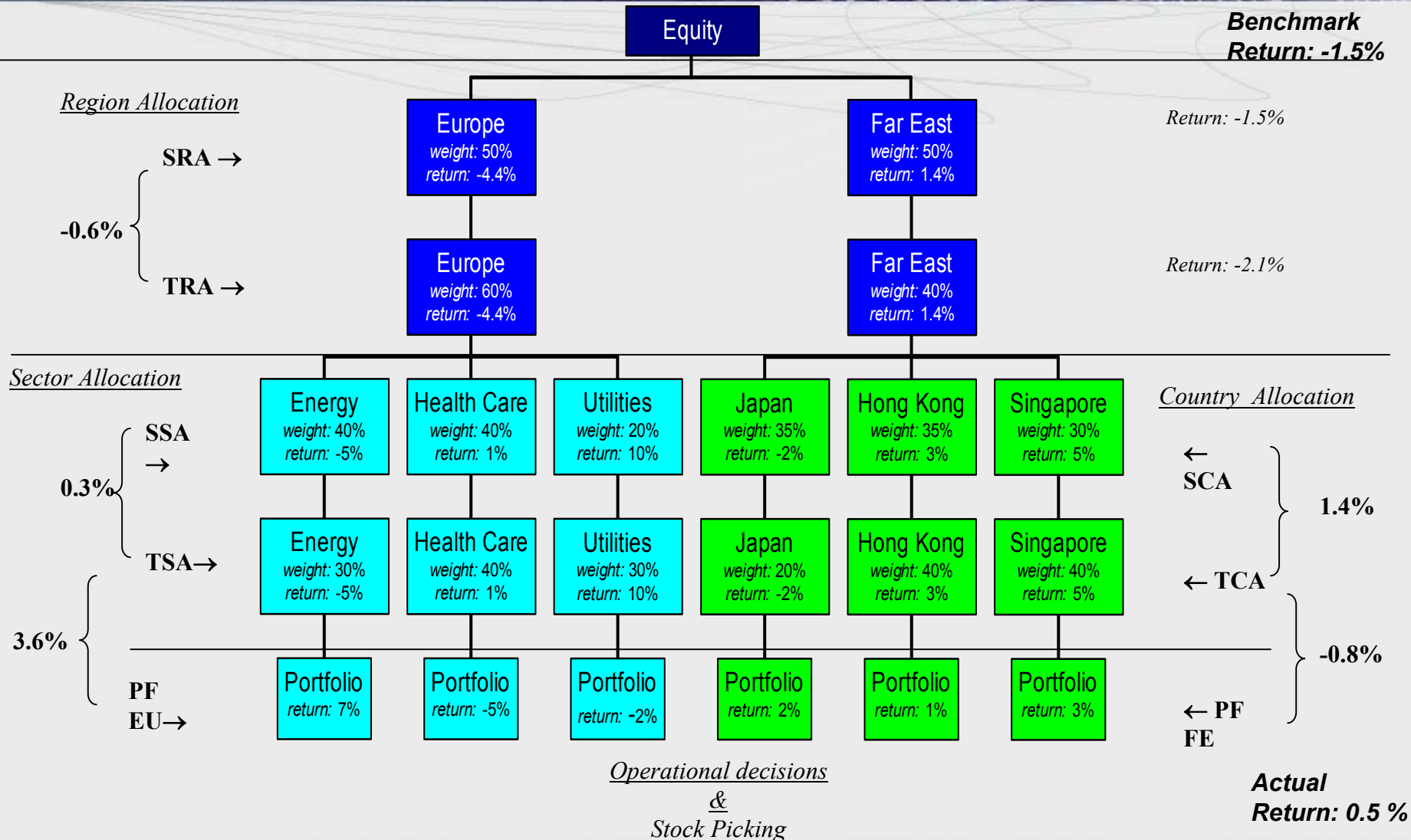
# Sample IDP



# Benchmark Structure



# IDP Decisions Analysis



# IDP Decisions Analysis

	<i>gain</i>	<i>return</i>
Benchmark	<b>(15,000.00)</b>	<b>-1.5%</b>
<b><u>REGION ALLOCATION</u></b>	<b>(5,800.00)</b>	<b>-0.6%</b>
<b><u>DECISIONS EUROPE</u></b>	<b>23,400.00</b>	<b>3.9%</b>
Sector allocation	1,800.00	0.3%
Stock picking	21,600.00	3.6%
<b><u>DECISIONS FAR EAST</u></b>	<b>2,400.00</b>	<b>0.6%</b>
Country allocation	5,600.00	1.4%
Stock picking	<b>(3,200.00)</b>	<b>-0.8%</b>
<b>ACTUAL Performance</b>	<b>5,000.00</b>	<b>0.5%</b>
<b>EXCESS Performance</b>	<b>20,000.00</b>	<b>2.0%</b>

## Appendix V: PEARL - System

## ▶ Why a system?

- ▶ **Complete Automation of Daily Process**
- ▶ **High measurement frequency**
- ▶ **System Requirements**
  - ▶ **Flexible**
  - ▶ **Transparent and verifiable**
  - ▶ **Database**
  - ▶ **Robust**
  - ▶ **High system performance**

## Interfacing and PEARL

- ▶ **Various interface-possibilities**
  - ▶ Flat files
  - ▶ Table-to-table
  - ▶ Manually
  - ▶ Etcetera
- ▶ **Flexible import function (import-templates)**
- ▶ **Free format input is converted to required format in PEARL**

# Interfacing and PEARL

**Text Data Interface Object MValue DSDump Dif (DefinitionView)**

Base path:

FileName:

TopText:

BottomText:

DumpFile  
 Insert 'wildcard'  
 Normal  Optima  
 Headers

Delimiter:

Values between:

Synchronization

Intern	Extern
<b>mktindex_id</b>	mktindex_id
value_date	value_date
currency_id	currency_id
value	cob_value
source	source

Column name:  Date Format:

Type:

**Import/Export Object Input Referentie CMI definitions Import (DefinitionView)**

Import  Export

Input DIF (ID 15000):

Output DIF (ID 400):

Synchronization

Remove	Import	Type	Export	Type
<input type="button" value="Add Default"/>	MI_ID	String	MI_ID	String
<input type="button" value="Up"/>	MI_DSC	String	MI_DSC	String
<input type="button" value="Down"/>	Default	String	CLIENT_ID	String
<input type="button" value="Begin"/>	CMI_YN	String	CMI_YN	String
<input type="button" value="End"/>	STARTDATE	Date	STARTDATE	Date
	ENDDATE	Date	ENDDATE	Date
	RETURN_YN	String	RETURN_YN	String
	CMI_LEVEL	Number	CMI_LEVEL	Number
	CCY_ID	String		
	DURATION_YN	String		

Entry Date  Make Upper  'wildcard' column

Append  No Comparison Column Default value:

Filter

## Interfacing and PEARL

- ▶ **PEARL contains a benchmark compiler**
  - ▶ Composition benchmarks
  - ▶ Flexible rebalance frequency
  - ▶ Rules strategic currency
  - ▶ Flexible hedge policies
  - ▶ Computes benchmarks for all IDP-levels
- ▶ **PEARL contains automatic data checks**
  - ▶ Input data is checked before actual performance is computed
  - ▶ Check-results are reported to PEARL-analyst
  - ▶ Checks can easily be extended or limited
  - ▶ Check-reports do not stop the computation process

## Computations in PEARL

- ▶ **Computations take place according to IDP-Model**
- ▶ **PEARL supports this by determining the investment process:**
  - ▶ Type of decisions
  - ▶ Hierarchy of decisions
  - ▶ Formulas + resulting measurement-method
  - ▶ Filling-in investment process is data-driven
- ▶ **Measurement frequency and methods are fully adjustable**



## Reporting with PEARL

- ▶ **PEARL supports the use of drill-down reports; every decision can be zoomed in on**
- ▶ **PEARL supports various report writers (e.g Crystal Reports and Business Objects)**
- ▶ **By using an ORACLE database any other report writer can be linked to PEARL**
- ▶ **Ad-hoc analyses possible on account of open data structure**

## Verification in PEARL

- ▶ **To guarantee accuracy of the performance data, verification of the computation process is essential**
- ▶ **Verification in PEARL**
  - ▶ Checks signal discrepancies in data (plausibility & reconciliation)
  - ▶ Computation process can be tracked via logging
  - ▶ If the data for the computation process is incomplete this will be included in the log file
  - ▶ All mutations are logged; consequently each data adjustment is traceable

## Flexibility in PEARL

- ▶ **There is no static situation: input data and properties change with time, as well as the report specifications**
- ▶ **Flexibility in PEARL**
  - ▶ PEARL is data-driven
  - ▶ Use of time-dependent properties
  - ▶ Use of templates in design PEARL, so PEARL can comply with non-standard requirements

## Computation speed in PEARL

- ▶ Detailed performance measurement requires the processing of huge amounts of data. This needs to be accomplished in a limited period of time. Therefore a good system performance is essential.
- ▶ **Computation speed in PEARL**
  - ▶ Use of delta-mechanism; only new and changed data is processed
  - ▶ Consequently computation time is related to the amount of new or back-dated data
  - ▶ After going through check-logs corrections can be computed in a short period of time

# PEARL Generic Objects

The screenshot displays the Pearl98 Calculation Manager application. The main window shows a tree view on the left with folders: Deleted, Not Existing yet, and Root Item. The central pane is titled 'Folder Root Item (SettingsView)' and contains the following fields:

- Name: Root Item
- Type: Folder
- ID: 30572
- Timestamp: 9/24/99 9:02:16 AM
- Version: (empty field)

Below these fields is a checkbox labeled 'Keep the status fixed when Calculated' which is unchecked. At the bottom of the settings pane are four buttons: Previous, Next, Save, and Reload. A yellow callout bubble points to the 'Version' field with the text 'object version management'.

An open dialog box titled 'Pearl98 - Select Objecttype' is shown in the foreground. It contains a list of available object types:

- Check
- Clear
- Conversion
- Conversion Template
- DecisionCluster
- DecisionType
- Deletion
- Dimension
- Folder
- Function Measure Type 1
- Function Measure Type 2
- IDP
- IDPRoot
- Import/Export
- Measure
- Measure Dimension Combination
- Oracle Data Interface
- Selection
- Text Data Interface

A yellow callout bubble points to the list with the text 'objects'. The taskbar at the bottom shows the Start button, several open applications (Microsoft PowerPoint, Exploring - DII, Pearl98 Calculation ...), and the system clock showing 9:17 AM.

# PEARL Conversion Templates

defining data conversions with the help of conversion templates

generated PL/SQL code

The screenshot displays the Pearl98 Calculation Manager interface. On the left, a tree view shows a project structure with folders like 'Deleted', 'Not Existing yet', 'Root Item', 'Checks', 'CONVERSION CONTROL DATABASE', and 'Conversions'. The main window shows a 'Conversion Template Object CONV\_MEASURES\_SAA (DefinitionView)'. It includes a 'Nesting' tree with 'BIGLOOP', 'IF', 'INSERT', and 'FREE' elements. To the right, there are fields for 'Output DIF' (MEASURES\_SAA), 'Statement', and 'Comments'. Below this is a table with columns 'Column', 'InsertValue', 'UpdateValue (...)', and 'UpdateValue'. The table contains rows for VDATE, CCY\_ID, DELTAMV, I, MV, NI, and REGION\_ID. A 'WordPad' window is overlaid on the bottom left, showing the generated PL/SQL code for the procedure 'proc\_CONV\_MEASURES\_SAA IS'. The code includes variable declarations and assignments for various fields like VAL\_BO\_EXRATE\_NB, VAL\_F1\_EXRATE\_NB, etc.

```

PROCEDURE proc_CONV_MEASURES_SAA IS
    Error_Message          VARCHAR2(10000);
    NumberOfRecordsInserted NUMBER;
    RecCount               NUMBER;
    TRACENR                number;
    TRACEMAX               number;
    NEWMUTNR               number;
    LASTMUTNR              NUMBER;
    VAL_BO_EXRATE_NB       OUT_EXRATE.VALUE*TYPE;
    VAL_B1_EXRATE_NB       OUT_EXRATE.VALUE*TYPE;
    VAL_BO_BASECCY_ID      TD_REGION.BASECCY_ID*TYPE;
    VAL_F1_BASECCY_ID      TD_REGION.BASECCY_ID*TYPE;
    VAL_BO_EXRATE_BASE     OUT_EXRATE.VALUE*TYPE;
    VAL_F1_EXRATE_BASE     OUT_EXRATE.VALUE*TYPE;
    VAL_BO_RETURN_BASE     OUT_EXRATE.CCYRETURN*TYPE;
    VAL_F1_RETURN_BASE     OUT_EXRATE.CCYRETURN*TYPE;
    VAL_BO_REGION_PLAN_W   TD_REGION.PLAN_W*TYPE;
    VAL_F1_REGION_PLAN_W   TD_REGION.PLAN_W*TYPE;
    VAL_BO_MI_RET_IN_BASE  float;
    VAL_F1_MI_RET_IN_BASE  float;
    VAL_BO_MV_TOTAL_IN_BASE float;
    VAL_BO_MV_OPER_RE_IN_BASE float;
    VAL_BO_ASSETCLASS_ID   REGION.ASSETCLASS_ID*TYPE;
    VAL_F1_ASSETCLASS_ID   REGION.ASSETCLASS_ID*TYPE;
    VAL_BO_PWEXRE          float;
  
```

# PEARL Calculation Manager

The screenshot displays the Pearl98 Calculation Manager interface. On the left, a tree view shows a hierarchy of objects including 'Group 4', 'Group 6', 'Group 7', and various 'DiFs' and 'CONV' objects. The main pane shows the 'Conversion Template Object CONV\_MEASURES\_SAA' with its sub-objects like 'FactorFromToCcy', 'MV\_CLIENT', and 'CONV\_MV\_CLIENT'. Below this, a 'Selected Object' panel shows details for 'CONV\_MEASURES\_SAA', including its ID (1586), type (Conversion Template), and status (Modified). An 'Execute' dialog box is open, allowing configuration of the job's execution. The dialog includes options for 'Priority Level' (No Priority, Low, High), 'Frequency' (Once, Weekly, Daily, Monthly, Yearly), and 'Execution Time' (Starting time: 09:12:03, Starting from date: 21/11/2011). It also has a 'Dependencies' section with a checked box for 'Include Calculating Dependend Objects' and an 'Execution Mode' section with checkboxes for 'Script Generation Only' and 'Debug Mode'. A yellow callout bubble points to the object tree with the text 'taking into account dependencies between objects'. Another yellow callout bubble points to the 'Execute' dialog with the text 'scheduling jobs to be executed on the ORACLE database'. The Windows taskbar at the bottom shows the Start button, open applications like Microsoft PowerPoint, Exploring, Pearl98 Calculation Manager, and WordPad, and the system clock showing 9:12 AM on 11/21/2011.

# PEARL Calculation Server

batch list

JobName	Starting Time	Expected Ending Time	Elapsed Time	Status	PriorityLevel	Frequency
CONV_MEASURES_SAA	22-11-1999 08:18:17	08:18:24	00:00:01	Calculating	No Priority	Once

Remove Job    Modify Job

Underlying PearlObjects

Object ID	Object Name	Elapsed Time	Expected Duration	Status
1586	CONV_MEASURES_SAA	00:00:01	00:00:09	Calculating

Close

progress information

Start    Microsoft PowerPoint - [scr...    Exploring - Presentatie    Pearl98 Calculation ...    untitled - Paint    8:18 AM

# PEARL Checks

**Pearl98 Calculation Manager**

File Edit View Operator Help

Check Object Check on clean prices in secprice (DefinitionView)

SELECT  
 SECPRICE.ACCR\_INT ACCR\_INT  
 .SECPRICE.CLEAN\_PRICE CLEAN\_PRICE  
 .SECPRICE.SECURITY\_ID SECURITY\_ID  
 .SECPRICE.VDATE VDATE

WindowNr: SECPRICE  
 Include Previous Values:   
 Join Remove Join

Call Table: Input SecPrice Dif

Condition	Error Message
((SECURITY_ID = SECURITY_ID(-1)) AND ((CLEAN_PRICE...	A1002

Condition: ((SECURITY\_ID = SECURITY\_ID(-1)) AND ((CLEAN\_PRICE < (0.9 \* CLEAN\_PRI  
 Error Message: A1002

Variables:  Insert

Description: Clean\_secprice van \$\$V2:SECURITY\_ID\$\$ is op \$\$V3:VDATE\$\$ met meer dan 10 % gewijzigd, namelijk met \$\$F0:ROUND((100 \* ((CLEAN\_PRICE - CLEAN\_PRICE(-1)) / CLEAN\_PRICE(-1)),1)\$\$ % sinds de laatst ingelezen waarde op \$\$V7:VDATE(-1)\$\$.

Add Modify F(Func)

template for user-defined checks & error messages

Type :Check Object ID :25405 Status :Calculated Name :Check on clean prices in secprice



# IDP creation decisions

modeling the investment decision process as a sequence of decisions

The screenshot shows the Pearl98 Calculation Manager interface. On the left is a tree view of the model structure, including folders for 'Deleted', 'Dirs IDP', 'Dimensions', 'Function Measures', 'IDP etc', 'Main IDP's', 'clusters', 'Decision types', 'roots', 'Measure Dimensions', 'Measures', 'INPUT DATABASE', 'temp', 'dummy oracle dif', and 'Notification List'. The 'clusters' folder is expanded, showing a hierarchy of decision objects: MAIN DC, OPER\_SP DC, OPER\_VIRKAS DC, SAA DC, TAA DC, TIMING DC, and TRA DC. The 'main-IDP root' folder is also expanded, showing 'main-IDP root' and 'Demo IDP'. The main window displays 'IDP Object Demo IDP (DefinitionView)' with buttons for 'New Instance', 'Delete Instance', and navigation arrows. Below this, the 'Instance Name' is 'JAN1999' and the 'Starting Date' is '12/31/98'. At the bottom are buttons for 'IDP Settings', 'Instance Settings', 'Test Definition', and 'Fill'. A 'Selection Tree Item' dialog box is open, listing the same decision objects as the tree view, with 'TIMING DC' selected. A yellow callout points to this dialog box with the text 'decision cluster objects'.

decision cluster objects

# IDP Defining decision types

DecisionType Object TIMING DT (DefinitionView)

Branch Property	Component	ID
AssetClass		
BudgetCashType		X
BudgetRegion		X
Client		

Dimension: AssetClass

Measures: MEASURES\_BR\_BCT md

Properties: PROP\_BR\_BCT md

Branch Properties: BP\_BR\_BCT md

Function Measures: bm\_gain\_per FM

- IA\_GAIN fm
- HEDGE\_GAIN fm
- GAIN\_CM fm**
- TOT\_GAIN fm
- TOT\_GAIN\_UH fm

Type :DecisionType Object ID :20678 Status :Calculated Name :TIMING DT

defining decision types:  
(branch) properties,  
measures & dimensions

# IDP measures on the IDP-level

FunctionMeasureType1 Object GAIN\_CM fm (DefinitionView)

Output Measure: GAIN\_CM

Measures	Measure	Lag
[Dropdown]		

Lag: [Input] [>>] [<<]

Condition: [Empty Field]

[F(x)] [F(x')] [G(F(x))] [Remove]

When condition TRUE

$$((I\_GAIN + (CCY\_GAIN + (PRICE\_GAIN + (IA\_GAIN + HEDGE\_GAIN)))) * XRATE)$$

[F(x)] [F(x')] [G(F(x))]

Type :FunctionMeasureType1 Object ID :20380 Status :Calculated Name :GAIN\_CM fm

Taskbar: Start | Microsoft PowerPoint - [PE... | Exploring - DII | Pearl98 Calculation ... | 9:21 AM

creating measures

# IDP the function wizard

The screenshot shows the Pearl98 Calculation Manager interface. On the left is a tree view of the project structure, including folders like 'Deleted', 'Not Existing yet', 'Root Item', 'Checks', 'CONVERSION CONTROL DATABASE', 'Conversions', 'Exception objects', 'EXTERNAL DATABASE', 'FLAT FILES', 'IDP', 'Difs IDP', 'Dimensions', 'Function Measures', 'Main IDP fm', 'Non-Summables', 'Summables', 'Weekly Measures fm', 'IDP etc', 'Measure Dimensions', 'Measures', 'Currency Overlay', 'IDP help', 'IDP input', 'Main IDP', 'INPUT DATABASE', 'temp', 'dummy oracle dif', and 'Notification List'. The 'GAIN\_CM fm' function is selected under 'Summables'.

The main window displays the 'FunctionMeasureType1 Object GAIN\_CM fm (DefinitionView)'. The 'Output Measure' is set to 'GAIN\_CM'. A 'Pearl98 Function Wizard - Function Definition' dialog box is open, showing the formula: 
$$((I\_GAIN + (CCY\_GAIN + (PRICE\_GAIN + (IA\_GAIN + HEDGE\_GAIN)))) * XRATE0)$$

The dialog box includes a 'Lag' field, a description '( Arg1 \* Arg2 )' with 'Multiplies two arguments', and options for 'Argument' (Arg1), 'Constant', 'Variable', and 'Function'. The 'Function' option is selected, and the formula is entered in the 'Function' field. Buttons for 'F(x)', 'F(x)', and 'G(F(x))' are visible. The dialog also has 'Help', 'Cancel', and 'OK' buttons.

A yellow callout bubble points to the formula field with the text: "edit formulas with the Function Wizard c".

At the bottom of the application window, the status bar reads: "Type :FunctionMeasureType1 Object ID :20380 Status :Calculated Name :GAIN\_CM fm".

# IDP the IDP-result view

The screenshot shows the Pearl98 Calculation Manager interface. On the left is a tree view with folders like 'Deleted', 'Root Item', 'DB1 DIFS', 'DB4 DIFS', 'IDP-invulling', 'Contribution Objects', and 'Difs IDP'. The main window displays 'IDP Object SSPF main (ResultView)' with a 'Current Date' of 31/12/1998 and a 'Recalculate' button. A tree structure shows nodes: SAA DC, REA DC, TAA DC, CA, EP, EQ, FI, SL, CO, RE, CA, EP, EQ. An 'Investment Components' dialog box is open, showing a tree with 'EQ' selected, containing sub-items: EQ\_EM, EQ\_OTHER, EQ\_AMERICA, EQ\_EUR, and EQ\_PACRIM. Below the tree, instance details are shown: Instance Name: JAN1999, Start Date Selected Investment: 2/12/98, Start Date: 12/31/98, End Date Selected Investment: 12/31/98, End Date: N.A., and a 'Rebuild Tree' button.

data-driven: available asset classes within the tactical asset allocation decions

zooming in on regions that make up the tactical equity decision

# IDP tracking the measures over time

The screenshot displays the Pearl98 Calculation Manager interface. On the left is a tree view of the IDP object structure, including folders like 'Deleted', 'Root Item', 'DB1 DIFS', 'DB4 DIFS', 'IDP-invulling', 'Contribution Objects', 'Difs IDP', 'Dimensions', 'Function Measures', 'clusters', 'Decision types', 'roots', 'SSPF futures', 'SSPF main', 'SSPF main v2', 'SSPF sector', 'SSPF sector oud', 'Measure Dimensions', 'Measures', 'Twan's conversies groep 1 tot 16', 'Notification List', and 'test FM object'. The 'SSPF main' folder is selected.

The main window shows 'IDP Object SSPF main (ResultView)'. It includes a 'Current Date' field set to '31/12/1998' and a 'Recalculate' button. Below this is a list of measures with expandable/collapsible icons: EQ\_EM, EQ\_OTHER, EQ\_AMERICA, EQ\_EUR (expanded), TBRA DC, EQ\_EUR\_INT, TIMING DC, OUTST\_SET, ACTHOLDING, PFSEL direct DC, and 1001EFRT.

A yellow callout bubble points to the tree view with the text: "graphical representation of the measures' history".

The 'Measures Graph for Investment EQ\_EUR' window is open, showing a line chart. The Y-axis is labeled 'EUR (x 1,000,000)' and ranges from 4,200 to 5,500. The X-axis is labeled 'Date' and shows dates from 01/01/1999 to 19/10/1999. The chart displays a single red line representing the measure's value over time, which fluctuates between approximately 4,600 and 5,100. A legend at the top of the graph area shows: - MV, - DELTAMV, - NI, - I.

At the bottom of the application window, the status bar reads: 'Type :IDP Object ID :20723 Status : Modified Name :SSPF main'.

## Unique benefits of the PEARL system

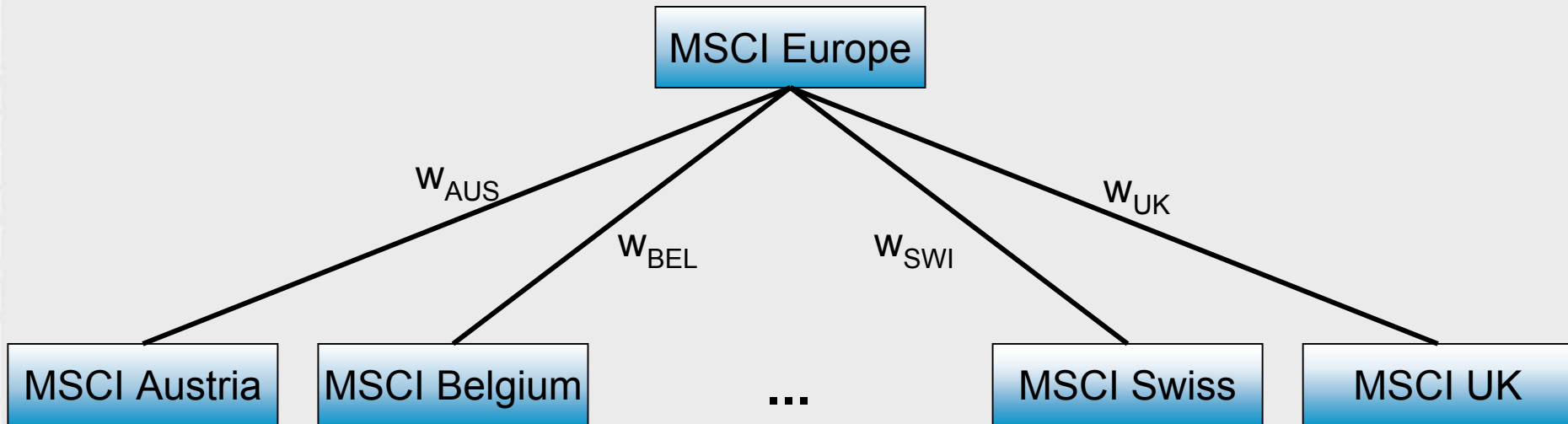
- ▶ **PEARL supports all aspects of the performance evaluation process, both technical and conceptual**
- ▶ **PEARL meets all technical requirements for a performance evaluation system**
- ▶ **PEARL allows focus on analyses instead of measurement**

## Appendix VI: Benchmark Compiler

# Benchmark Compiler

## Modeling Benchmarks

- ▶ Customized
- ▶ Composite



## ▶ Benchmark Compiler

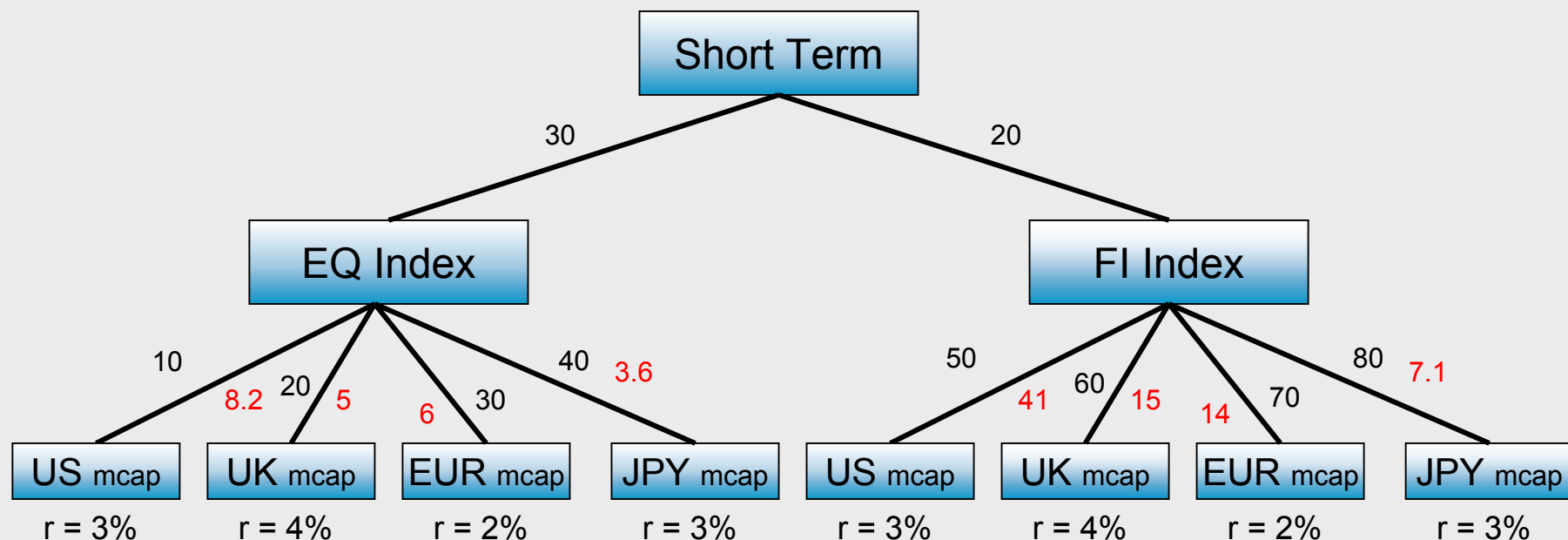
### Key functionalities

- ▶ Rebalancing
  - ▶ flexible frequency (daily, weekly, monthly, et cetera)
- ▶ Analysis to underlying currencies
- ▶ Excluding indices
  - ▶ e.g. MSCI Europe without MSCI UK
- ▶ Constructing total return indices
  - ▶ based on price index and yield index (dividend)

# Benchmark Compiler

## Example 1 – Short Term Index

- ▶ Marketcap factors into weights is customized calculation
  - ▶ e.g. made by customized conversion (PEARL) or GIC system



US factor = 49.2923

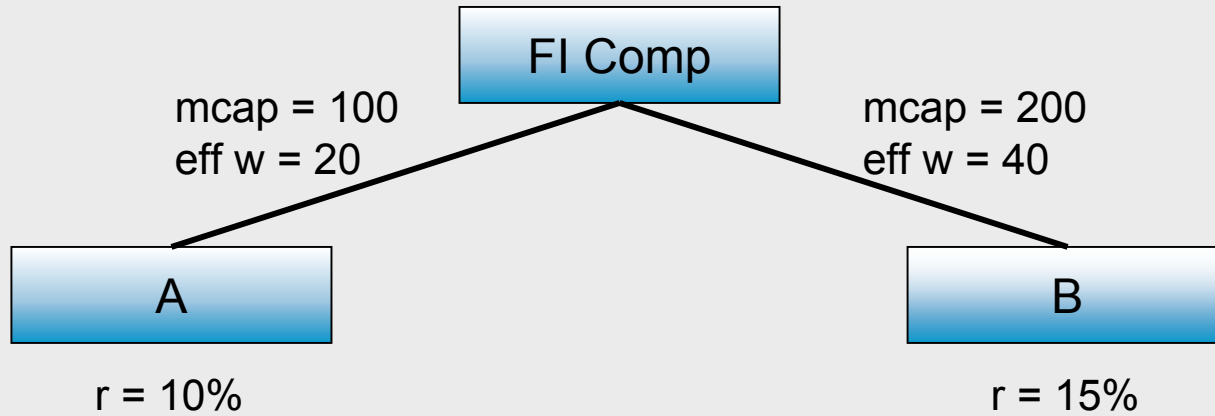
UK factor = 20

EUR factor = 20

JPY factor = 10.7077

# Benchmark Compiler

## Example 2 – Composite Fixed Income



# Benchmark Compiler

## Example 3 – Short Term Index, underlying currencies

- ▶ Based on example 1
- ▶ Market cap in local currencies

