IIPC Illmer Investment Performance Consulting AG

Decision-oriented return and risk attribution – decomposing the performance of multi-layer investment processes

Date: 11th July 2013

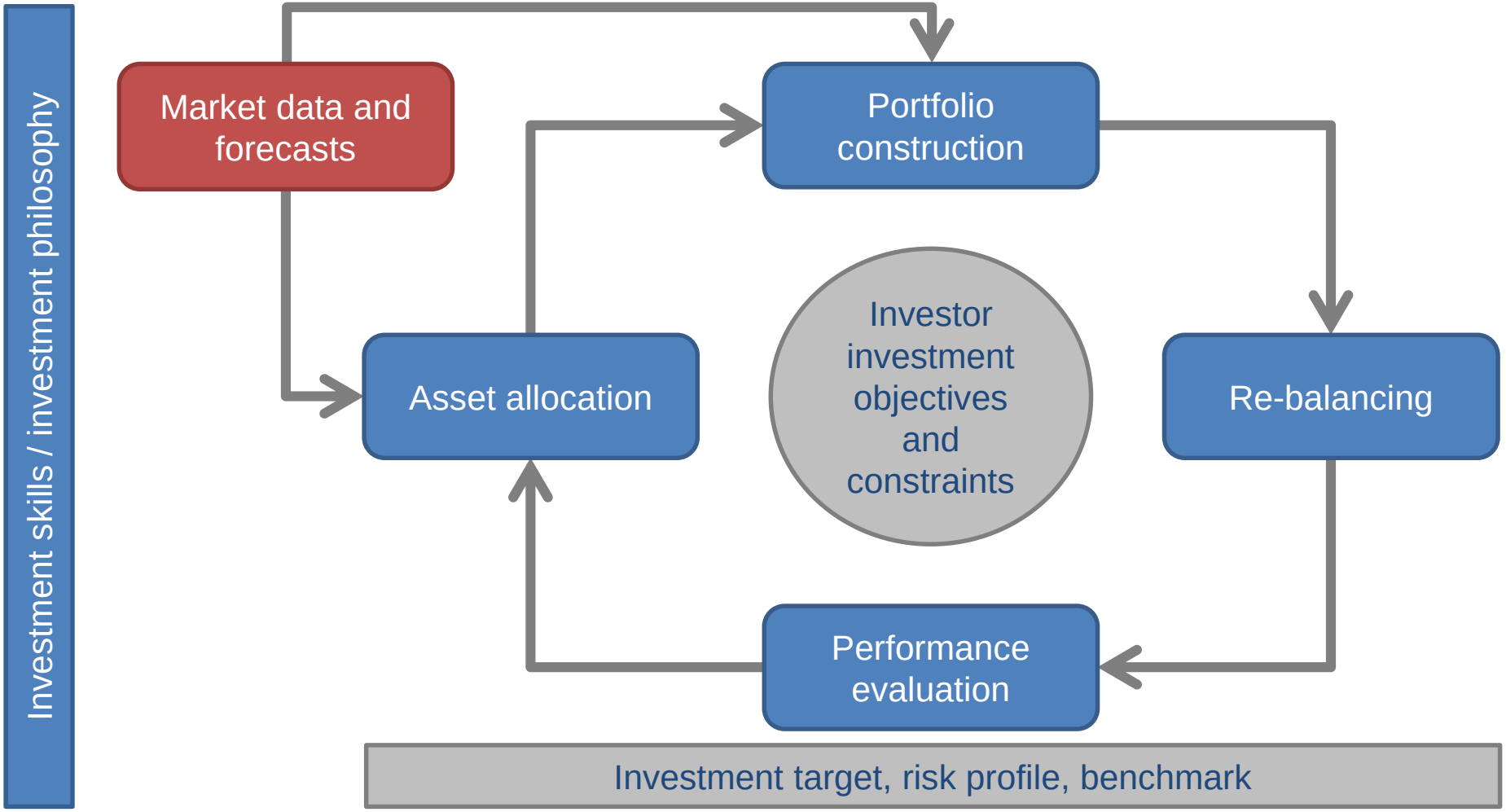
Produced by: Dr. Stefan J. Illmer

Agenda

- Performance attribution as part of performance evaluation
- Case study on decision-oriented return attribution
- General framework for decision-oriented return attribution
- General framework for decision-oriented risk attribution
- Thoughts on combining return and risk attribution for multi-layer investment processes
- Comments and questions
- Contact details and disclaimer

Performance attribution as part of performance evaluation

Performance evaluation and the investment process

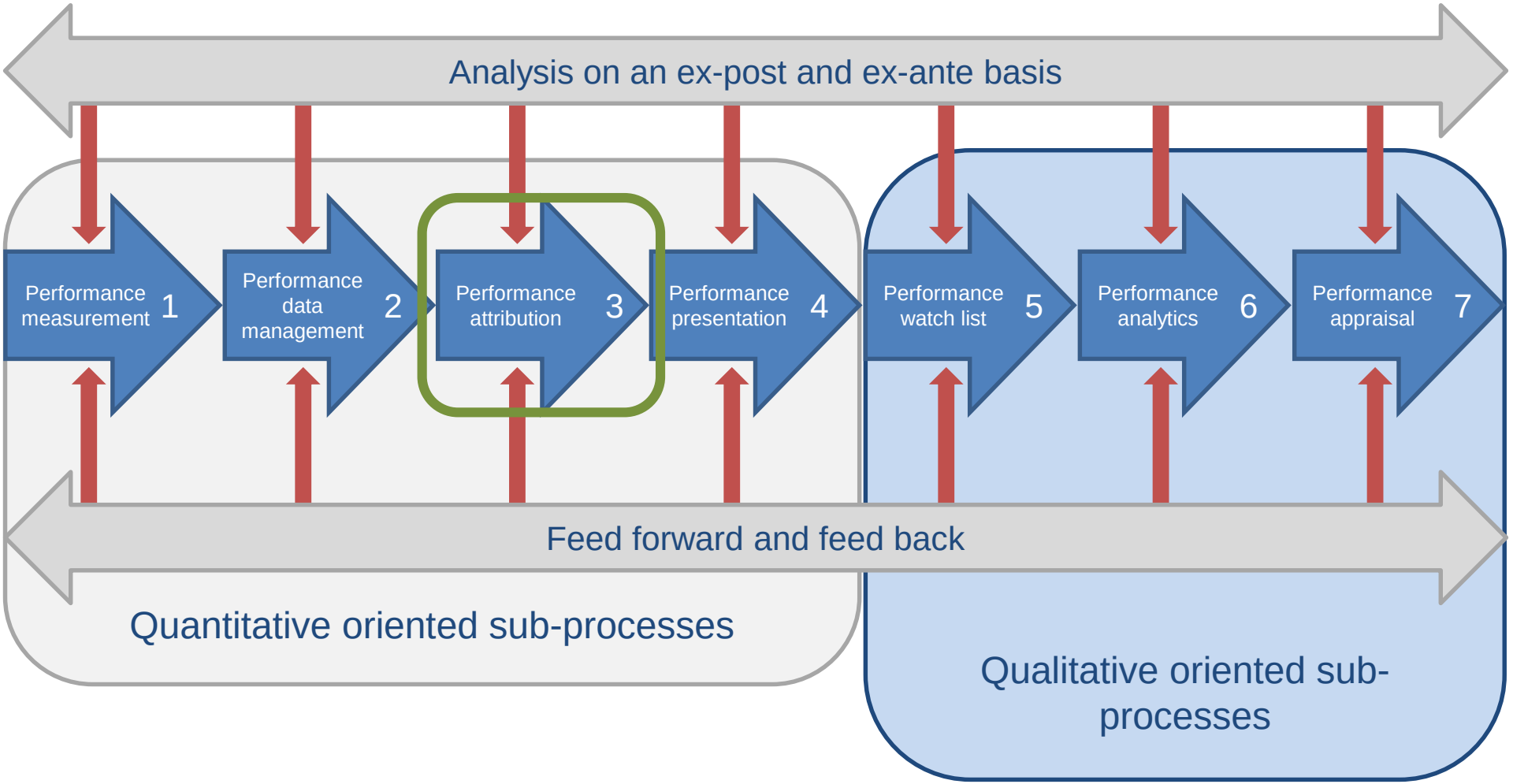


Performance evaluation – Definition

Performance evaluation covers all activities for collecting, measuring, presenting, analyzing and interpreting investment performance information.

It is a revolving process that outlines the steps in performance measurement, performance data management, performance attribution, performance presentation, performance watch list, performance analytics and performance appraisal.

Performance evaluation – The process

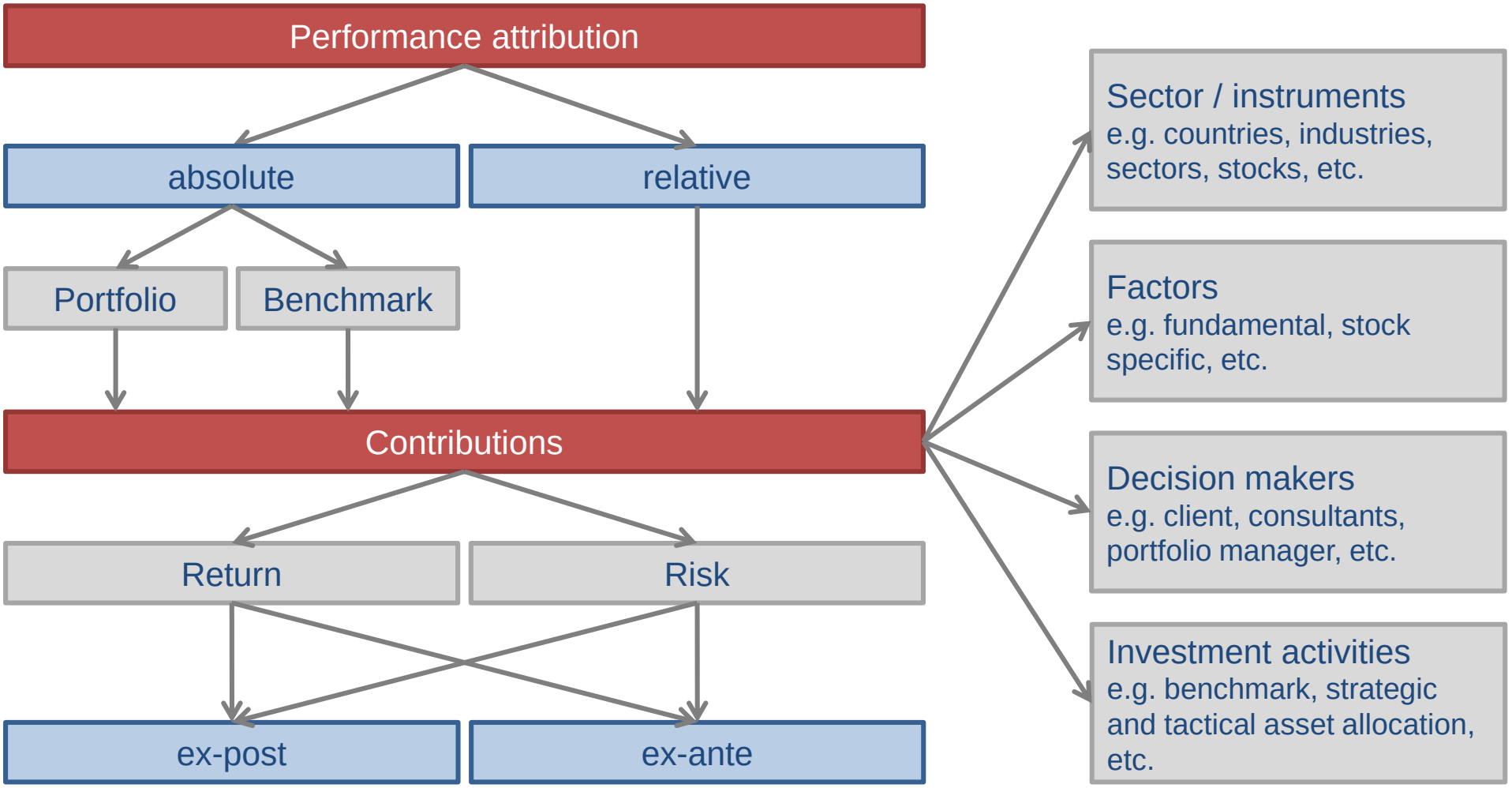


Performance attribution – Definition

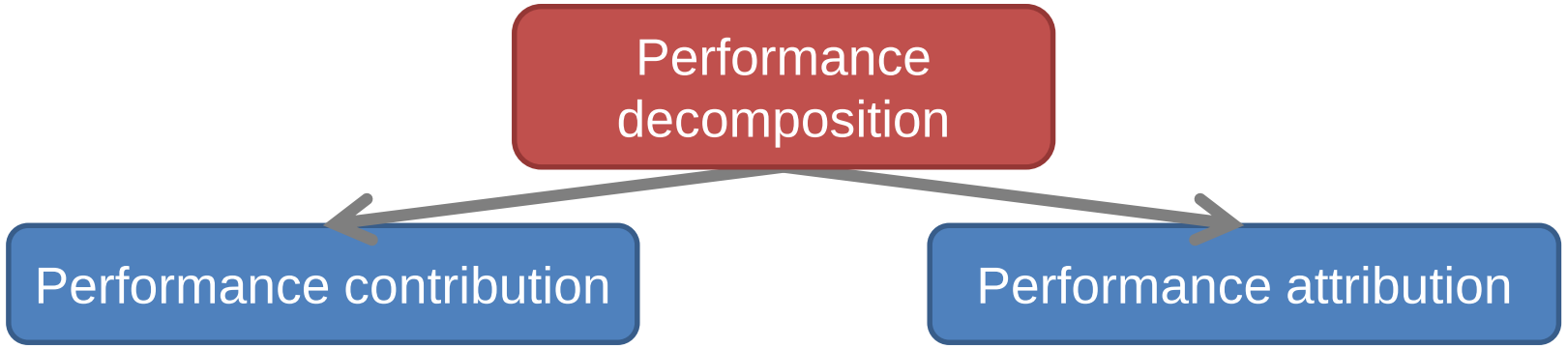
Performance attribution is the measurement and quantification of the historical as well as expected return and risk contributions of the individual steps of the investment process as well as of the applied financial instruments.

How did the investment portfolio produce its past performance and what are the sources of expected future performance?

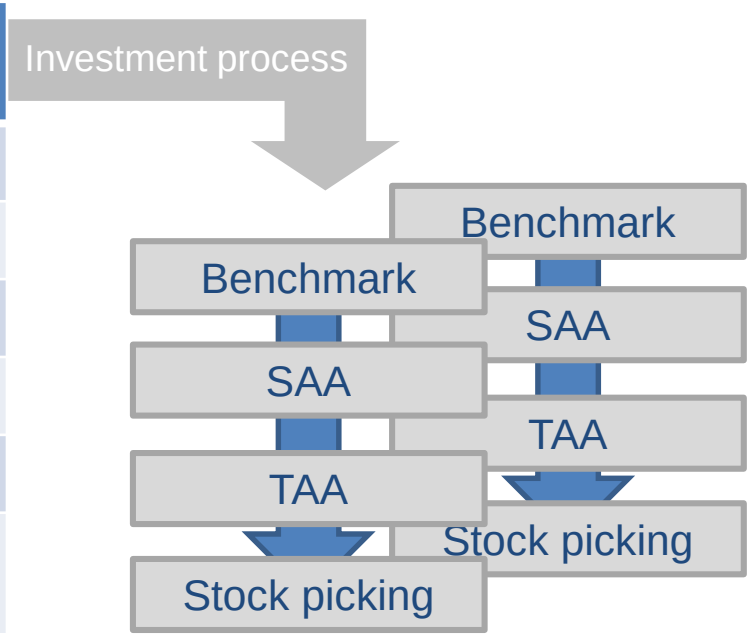
Performance attribution - The big picture



What is performance attribution?



Contributions to return and risk (absolute or relative)		
Equities	Bonds	Etc.
USA	Europe	Etc.
Financials	Telecom	Etc.
AAA	AA	Etc.
USD	JPY	Etc.
Asset allocation	Stock picking	Etc.



Common practice return attribution (1/2)

	Portfolio			Benchmark			Management Effects			
	Return	Weight	Contri-bution	Return	Weight	Contri-bution	Asset allocation	Stock picking	Interaction	Total
Cash	0.10%	2.00%	0.00%	0.10%	15.00%	0.02%	-0.01%	0.00%	0.00%	**-0.01%**
Domestic Bonds	-1.00%	14.00%	-0.14%	1.00%	25.00%	0.25%	-0.11%	-0.50%	0.22%	**-0.39%**
Foreign Bonds	-2.65%	15.00%	-0.40%	2.00%	15.00%	0.30%	0.00%	-0.70%	0.00%	**-0.70%**
Domestic Equities	14.00%	25.00%	3.50%	12.20%	12.00%	1.46%	1.59%	0.22%	0.23%	**2.04%**
Foreign Equities	16.00%	25.00%	4.00%	14.00%	14.00%	1.96%	1.54%	0.28%	0.22%	**2.04%**
Mortages	1.00%	3.00%	0.03%	1.00%	3.00%	0.03%	0.00%	0.00%	0.00%	**0.00%**
Real Estate	-1.00%	10.00%	-0.10%	-1.00%	10.00%	-0.10%	0.00%	0.00%	0.00%	**0.00%**
Commodities	2.00%	4.00%	0.08%	2.00%	4.00%	0.08%	0.00%	0.00%	0.00%	**0.00%**
Private Equity	1.00%	1.00%	0.01%	1.00%	1.00%	0.01%	0.00%	0.00%	0.00%	**0.00%**
Hedge Funds	3.00%	1.00%	0.03%	3.00%	1.00%	0.03%	0.00%	0.00%	0.00%	**0.00%**
Total	**7.01%**	**100.00%**	**7.01%**	**4.04%**	**100.00%**	**4.04%**	**3.00%**	**-0.70%**	**0.67%**	**2.98%**

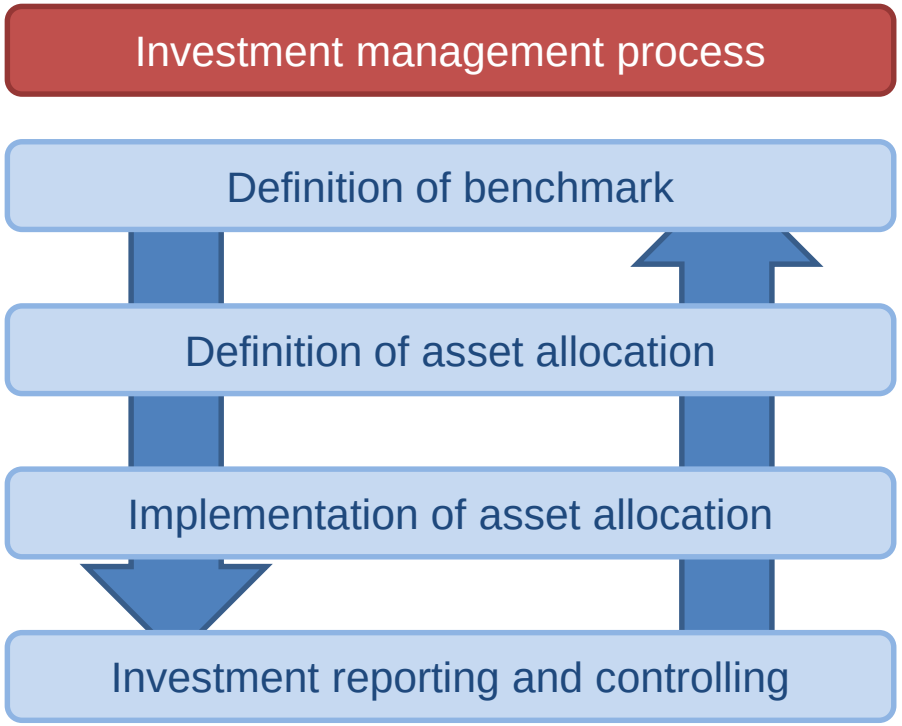
Common practice return attribution (2/2)

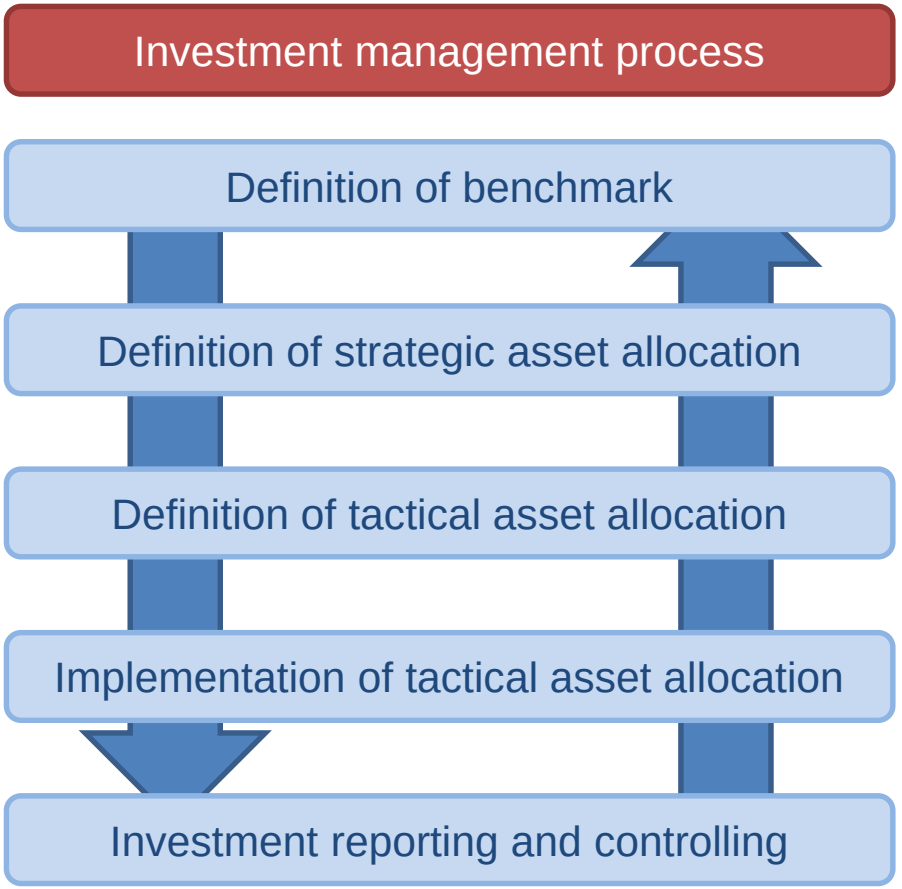
Underlying assumptions:

- Three step decision making process consisting of:
  - Benchmark selection,
  - Asset allocation and
  - Stock picking.
- Investment decisions can be implemented, means:
  - Investment restrictions are not considered.
  - Level of freedom for implementing the investment decisions is not considered.
- Transaction costs, fees and taxes are covered by the stock picking effect.
- Benchmark do not consider transaction costs, fees or taxes.

=> Are these assumptions appropriate for all investment management processes?

Are all steps of the decision making process reflected? (1/2)





=> Investment management process may vary substantially depending on the specific investor or investment organization.

Are all steps of the decision making process reflected? (2/2)

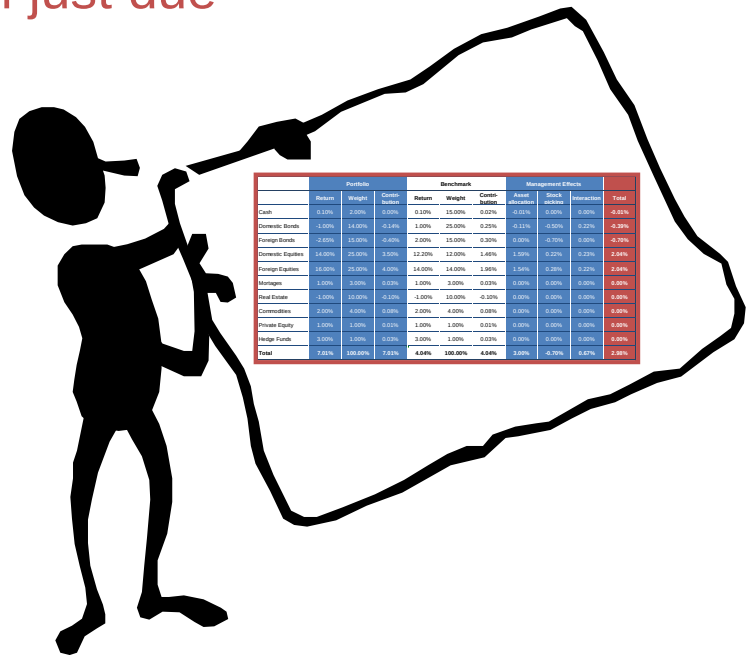
- Common practice to decompose the absolute or excess return and risk of an investment portfolio assume a “simple” investment management process.
- Often more complex investment management processes are observed.
- Applying a “simple” decomposition of the absolute or excess return and risk of an investment portfolio to more complex investment management processes may bear the risk of misinterpretations and with this of the risk of wrong feedback to the participants of the investment management process.
- Therefore often a decision-oriented or a target-oriented investment performance monitoring is not possible.

=> Performance attribution needs to be adjusted. A solution for reflecting all steps of the investment management process is the decision-oriented decomposition of the absolute or excess return and risk.

Case study on decision-oriented return attribution

Case study on decision-oriented return monitoring (1/7)

- Starting point:
  - Presentation to the investment committee explaining a return attribution.
  - Analysis shows 2% excess return just due to stock picking.

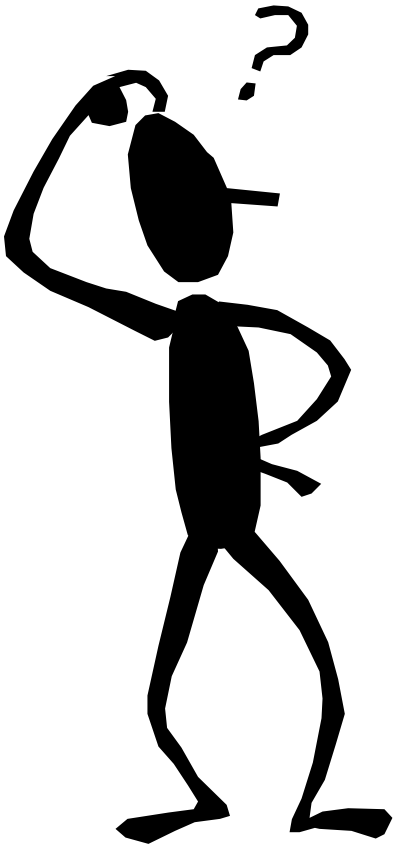


	Portfolio			Benchmark			Management Effects			
	Return	Weight	Contribution	Return	Weight	Contribution	Asset allocation	Stock selection	Interaction	Total
Cash	0.10%	2.00%	0.00%	0.10%	15.00%	0.02%	-0.01%	0.00%	0.00%	-0.01%
Domestic Bonds	-1.00%	14.00%	-0.14%	1.00%	25.00%	0.25%	-0.11%	-0.50%	0.22%	-0.39%
Foreign Bonds	-2.65%	15.00%	-0.40%	2.00%	15.00%	0.30%	0.00%	-0.70%	0.00%	-0.70%
Domestic Equities	14.00%	25.00%	3.50%	12.20%	12.00%	1.46%	1.59%	0.22%	0.23%	2.04%
Foreign Equities	16.00%	25.00%	4.00%	14.00%	14.00%	1.96%	1.54%	0.28%	0.22%	2.04%
Mortages	1.00%	3.00%	0.03%	1.00%	3.00%	0.03%	0.00%	0.00%	0.00%	0.00%
Real Estate	-1.00%	10.00%	-0.10%	-1.00%	10.00%	-0.10%	0.00%	0.00%	0.00%	0.00%
Commodities	2.00%	4.00%	0.08%	2.00%	4.00%	0.08%	0.00%	0.00%	0.00%	0.00%
Private Equity	1.00%	1.00%	0.01%	1.00%	1.00%	0.01%	0.00%	0.00%	0.00%	0.00%
Hedge Funds	3.00%	1.00%	0.03%	3.00%	1.00%	0.03%	0.00%	0.00%	0.00%	0.00%
Total	**7.01%**	**100.00%**	**7.01%**	**4.04%**	**100.00%**	**4.04%**	**3.05%**	**-0.70%**	**0.67%**	**2.98%**

Case study on decision-oriented return monitoring (2/7)

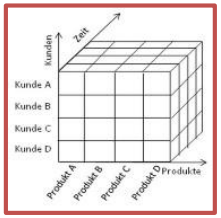
- Investment committee member questioned the analysis and especially the asset allocation effect being 0% because:
  - Investment committee did a big asset allocation bet by heavily overweighting equities – in a very bullish equity market.
  - According to theory asset allocation effect (AAE) should positively contribute to the excess return.

    AAE = difference in weight * return of index
- As above logic seemed reasonable – what happened?

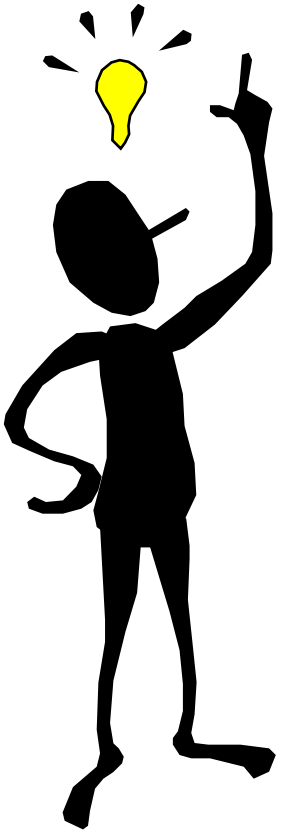


Case study on decision-oriented return monitoring (3/7)

- As the overall portfolio and benchmark returns were correct the decomposition of the excess return must be inappropriate or misleading.
- Thinking of the controlling cube maybe the answer comes from the way how the excess return is decomposed.

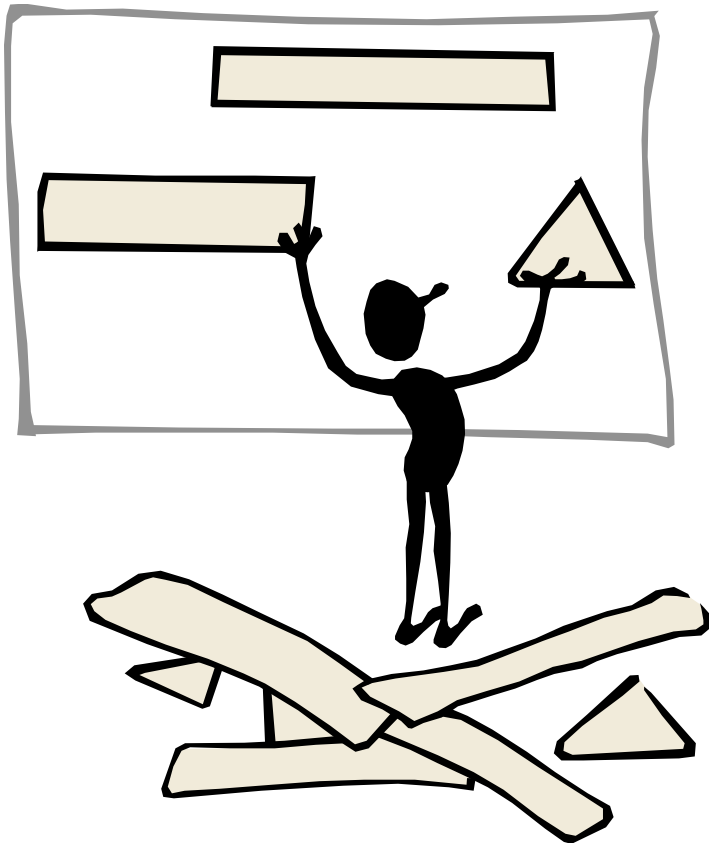


- Drivers for the decomposition are the decisions made what led to the conclusion that the investment decisions are not reflected properly.



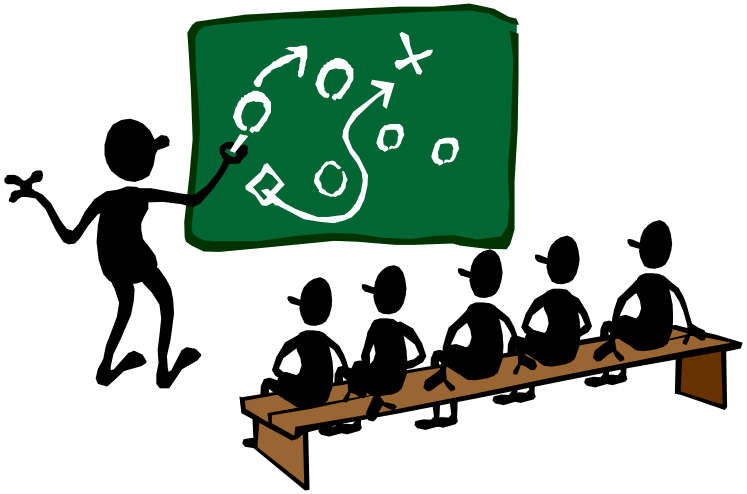
Case study on decision-oriented return monitoring (4/7)

- Investment management process was reviewed and decisions as well as decision makers identified.
- Return attribution was adjusted accordingly and the new decomposition proofed what was expected: a positive asset allocation effect of 5%.
- To make the excess return a positive 2%, the stock picking effect had to be a negative 3%.



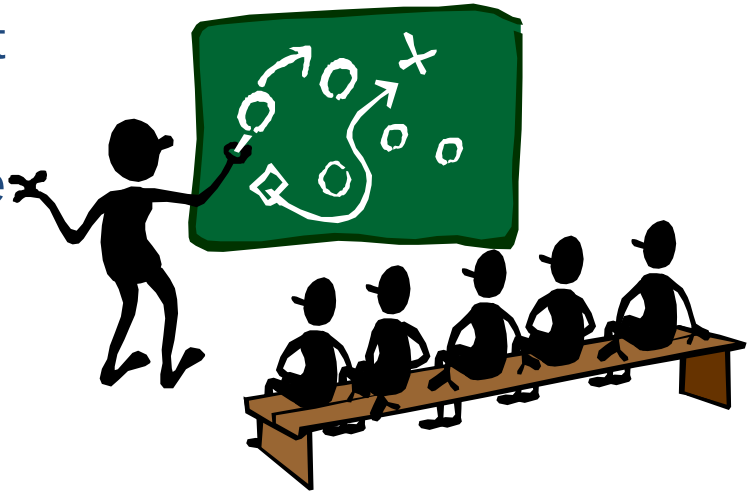
Case study on decision-oriented return monitoring (5/7)

- Conclusions (1/2):
  - Investment committee mandated the portfolio manager to implement investment decisions.
  - Portfolio manager had no obligation to implement the decisions of the investment committee and the right to deviate by 100%.
  - There was no monitoring of the implementation of the approved asset allocation.
  - Portfolio manager did not implement the overweight in equities but instead left it invested in cash instruments.



Case study on decision-oriented return monitoring (6/7)

- Conclusions (2/2):
  - Aspired overweight in equities was not reflected in the return attribution.
  - Negative impact of the cash investments versus an investment in equities was not considered in the return attribution.
  - Original return attribution did not reflect the actual investment management process.
  - Misleading investment performance monitoring led to misinterpretations.



Case study on decision-oriented return monitoring (7/7)

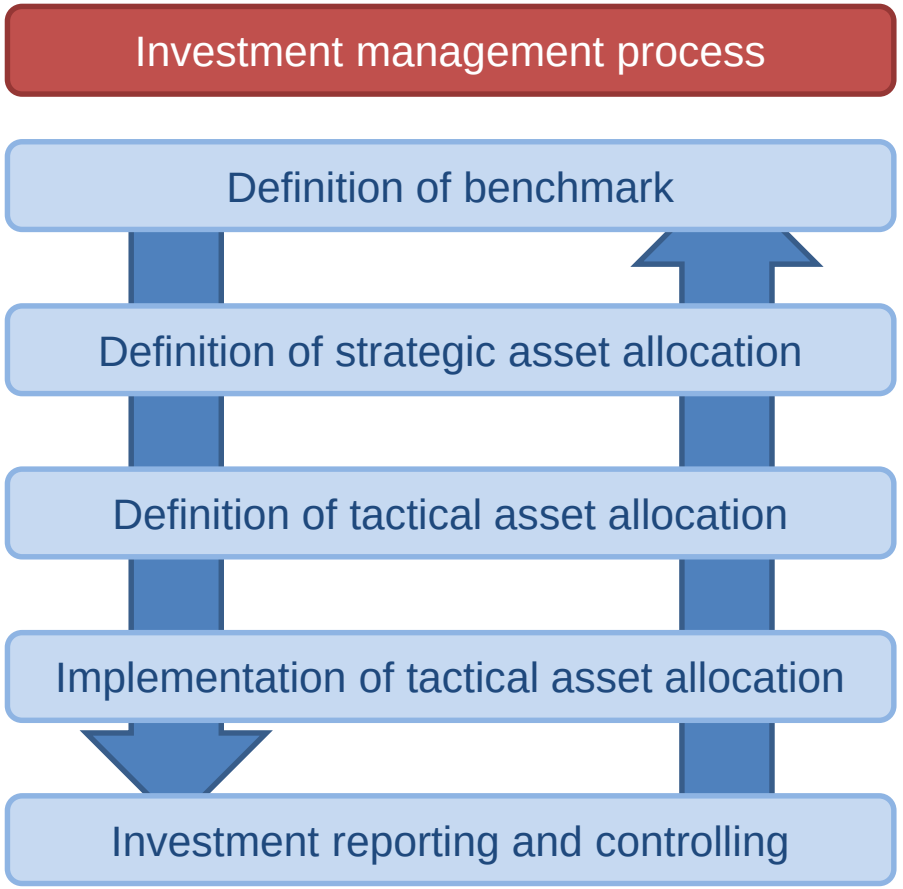
- Follow ups:
  - Investment management process was adjusted.
  - Investment restrictions and respective controls were implemented.
  - Return attribution was adjusted to reflect the whole investment management process.
  - Investment performance monitoring was recognized as a valid tool to improve the processes as well as the performance and therefore integrated into the regular investment management process.

General framework for decision-oriented return attribution

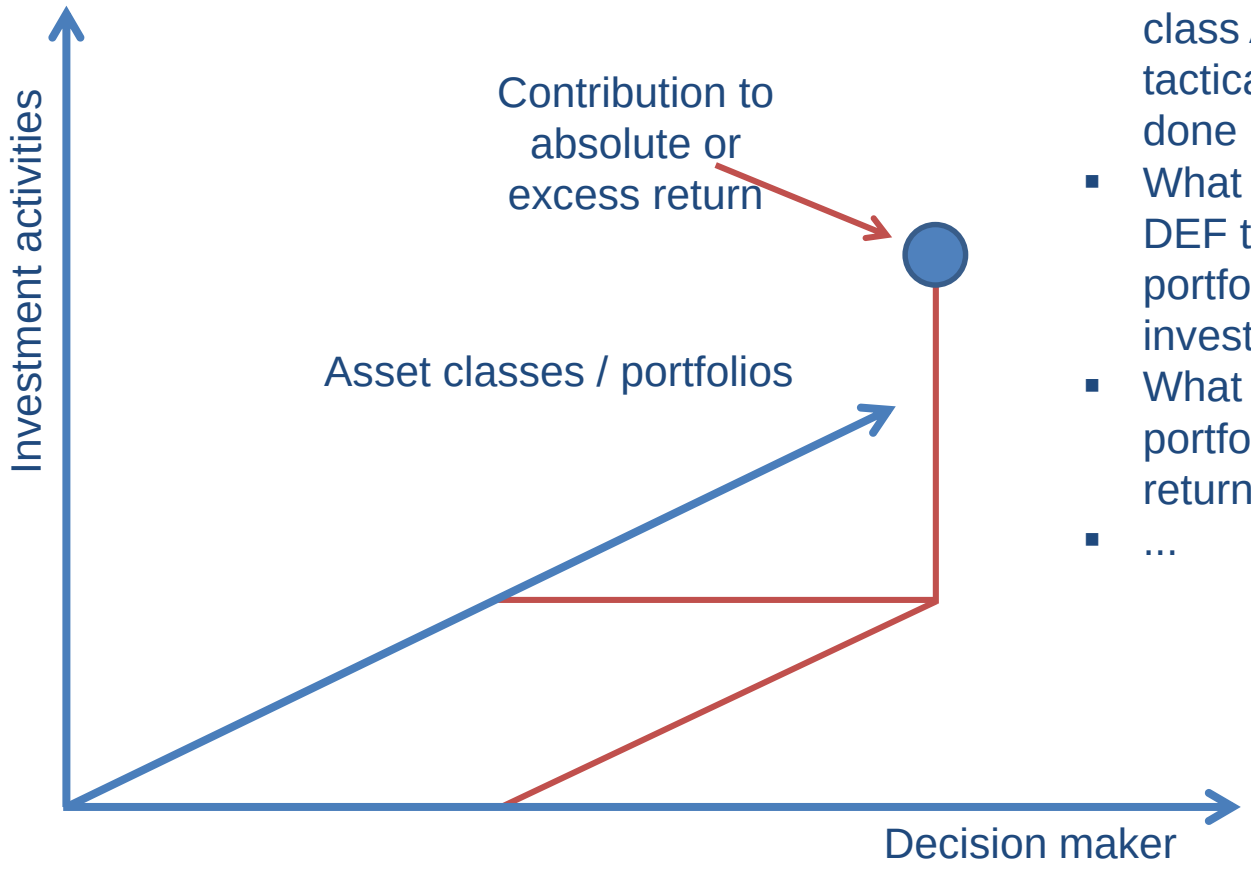
Definition – Decision-oriented return attribution

Decision-oriented return attribution is the decomposition of the absolute or excess return of an investment portfolio according to specific investment decisions done by specific decision makers.

The decomposition approach is difficult to standardize and therefore normally tailor-made as the relevant investment management processes differ – sometimes substantially.

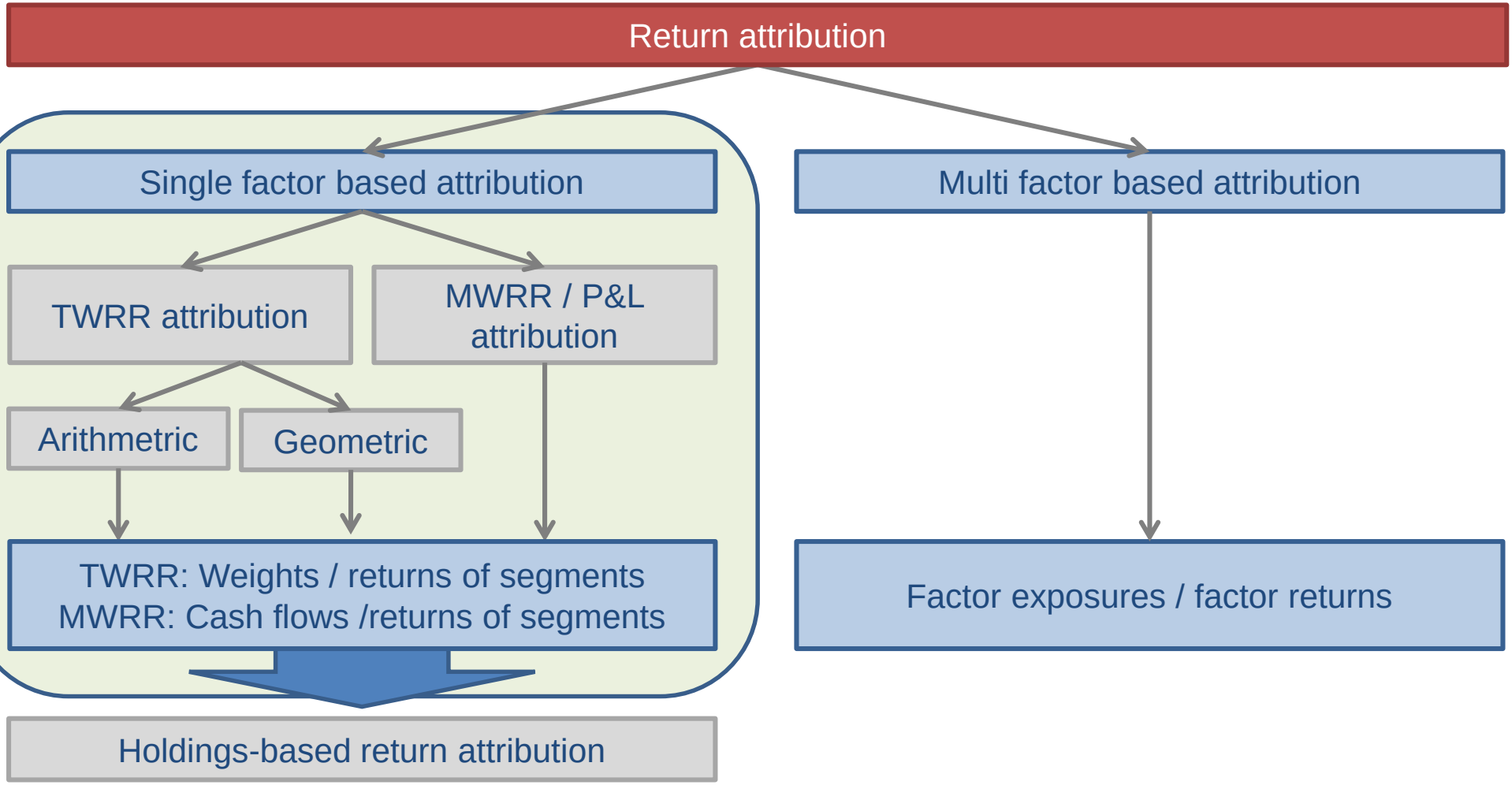


Aspects addressed and clarified



- What is the contribution of the asset class ABC to excess return due to tactical asset allocation decisions done by the investment committee.
- What is the contribution of portfolio DEF to absolute return due to portfolio positioning done by the investment committee.
- What is the contribution of the portfolio manager GHI to excess return due to stock picking decisions.
- ...

Return attribution - The big picture



Generic decomposition approach

Decision-oriented decomposition of the absolute (excess) return allows to quantify the return contribution or the value added of the individual decision makers and is based on the following steps:

- Step 1: Identify the circumstances, the investment management setup, and derive relevant assumptions for calculation.
- Step 2: Mirror the specific investment decisions into (absolute) asset allocations.
- Step 3: Calculate the corresponding returns.
- Step 4: Assign the returns as well as the return differences to the investment decisions and to the relevant decision makers.

Example – Step 1 (Investment process) (1/2)

Analyze the circumstances or characteristics relevant for the investment portfolio:

- Decision makers:
  - Board of directors.
  - Investment committee.
  - Portfolio managers.
- Monthly revolving investment management process.
- Investment portfolio invests in four asset classes:
  - Domestic bonds.
  - Foreign bonds.
  - Domestic equities.
  - Foreign equities.

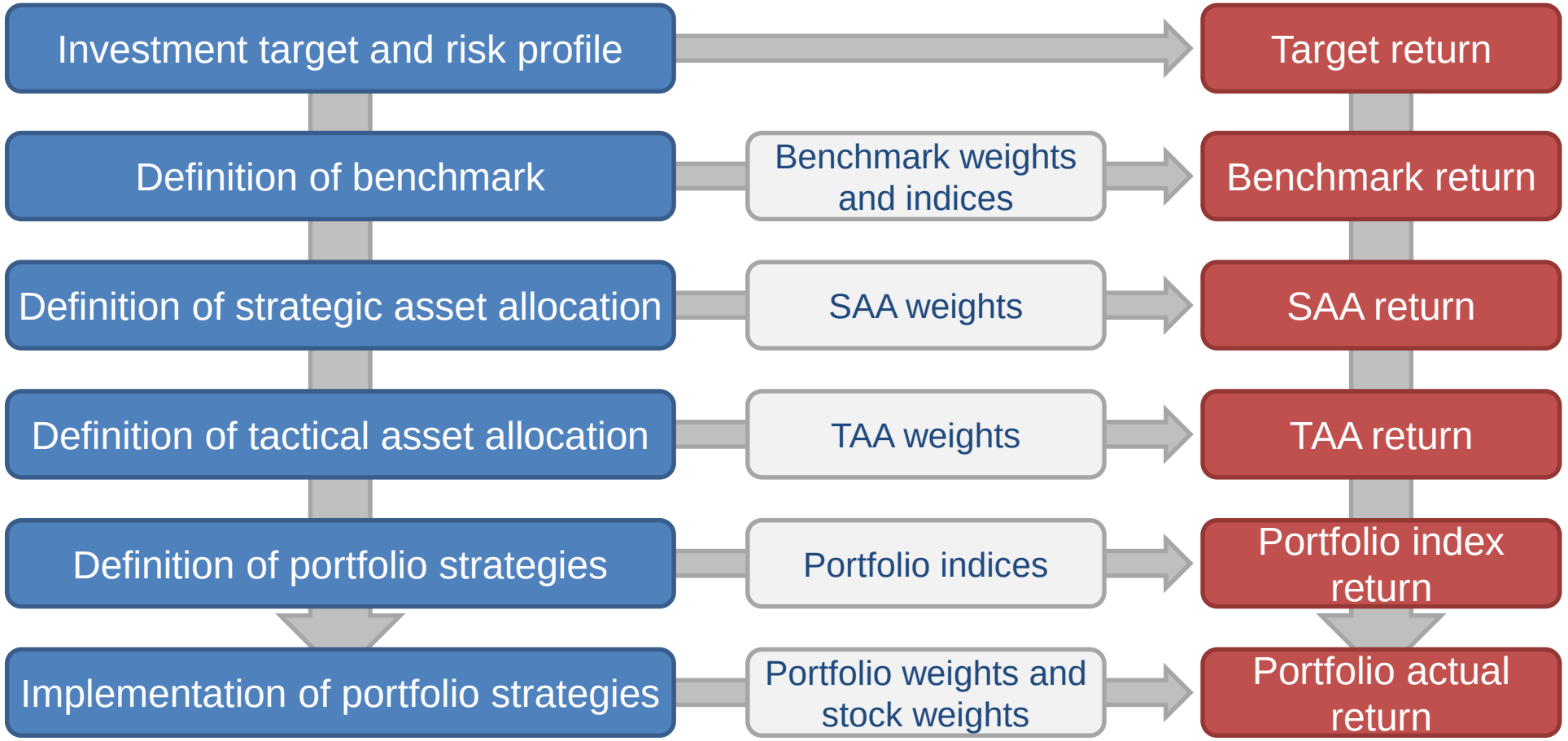
Example – Step 1 (Investment process) (2/2)

- Investments are managed through eight sub-portfolios – two for each asset class.
- No specific investment restrictions to be considered.
- 5 step investment management process:
  - Definition of benchmark.
  - Definition of strategic asset allocation.
  - Definition of tactical asset allocation.
  - Definition of portfolio strategies.
  - Implementation of portfolio strategies.

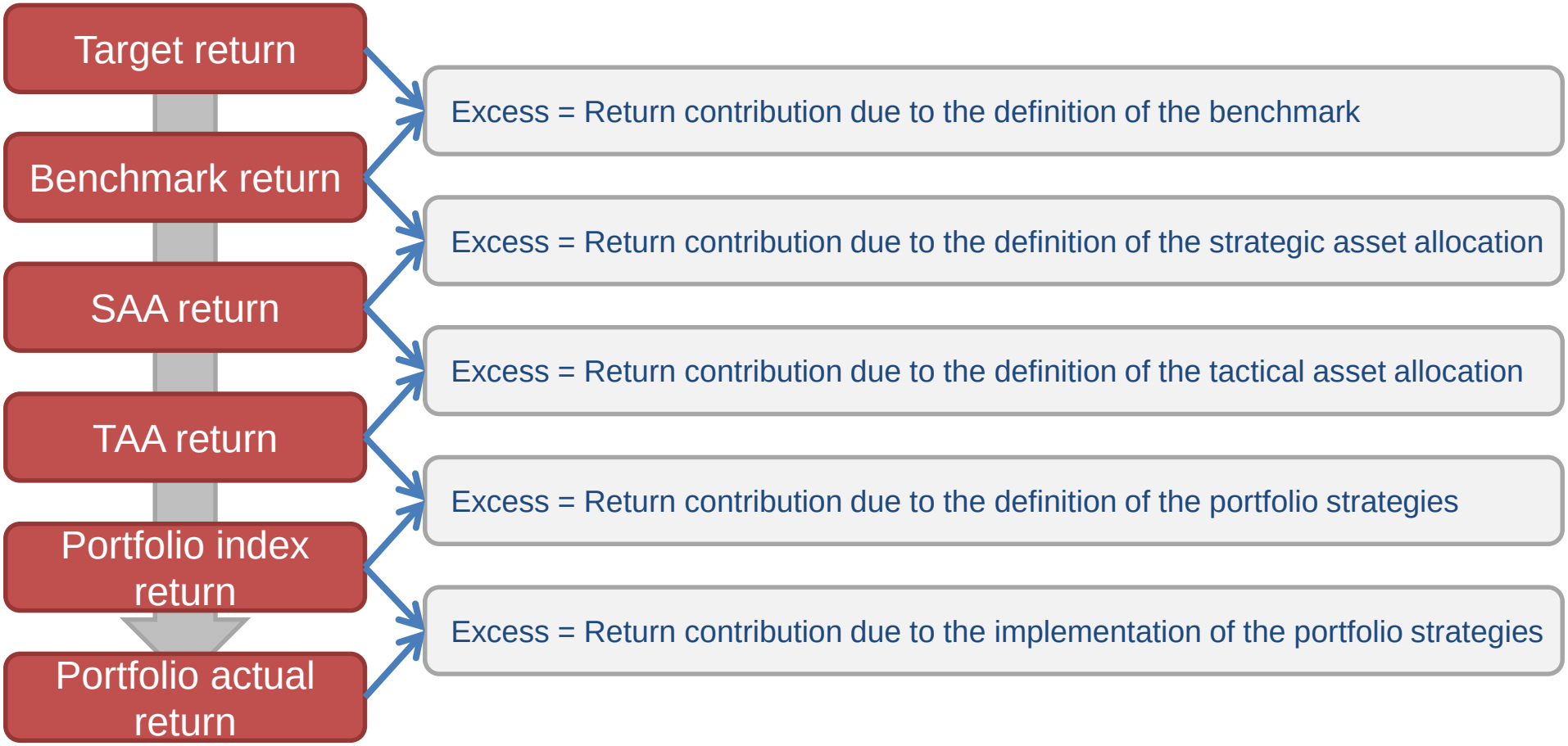
Example – Step 2 (Mirror investment decisions)

Weights	Benchmark	Strategic asset allocation	Tactical asset allocation	Portfolio strategies allocation	Actual portfolio allocation
Domestic bonds	10.00%	10.00%	10.00%	10.00%	12.00%
Foreign bonds	20.00%	10.00%	25.00%	25.00%	23.00%
Domestic equities	30.00%	35.00%	55.00%	55.00%	55.00%
Foreign equities	40.00%	45.00%	10.00%	10.00%	10.00%
Total assets	100.00%	100.00%	100.00%	100.00%	100.00%

Example – Step 3 (Calculation of returns) (1/3)



Example – Step 3 (Calculation of returns) (2/3)



Example – Step 3 (Calculation of returns) (3/3)

Target return
3.66%

-

Portfolio actual return
1.92%

Surplus return for the investment portfolio => **- 1.74%**

= Return contribution due to benchmark definition => **- 2.33%**

+ Return contribution due to strategic asset allocation => **- 0.06%**

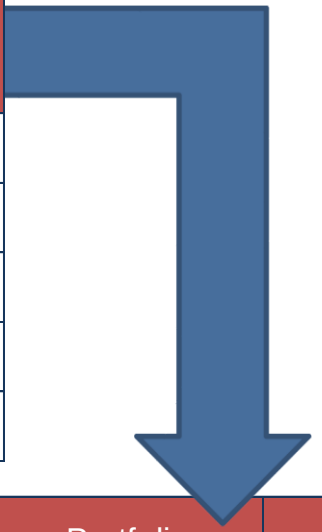
+ Return contribution due to tactical asset allocation => **+ 0.09%**

+ Return contribution due to portfolio strategies => **+ 0.33%**

+ Return contribution due to implementation => **+ 0.23%**

Example – Step 4 (Assigning of (excess) returns) (1/2)

	Asset allocation effect	Stock picking effect	Interaction effect	Total management effects
Domestic bonds	-0.20%	0.61%	0.00%	0.41%
Foreign bonds	-0.30%	-0.58%	0.05%	-0.83%
Domestic equities	-0.43%	0.61%	0.00%	0.18%
Foreign equities	-1.35%	-0.15%	0.00%	-1.50%
Total assets	-2.28%	0.49%	0.05%	-1.74%

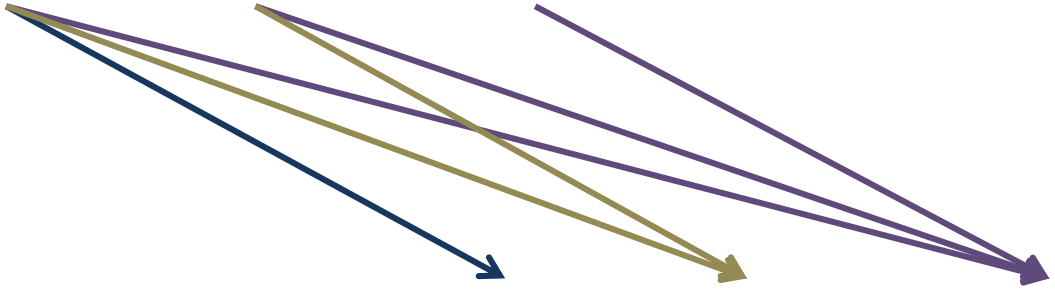


	Board of directors	Investment committee	Portfolio manager	Total management effects
Domestic bonds	-0.25%	0.48%	0.17%	0.41%
Foreign bonds	-0.37%	-0.06%	-0.40%	-0.83%
Domestic equities	-0.74%	0.30%	0.61%	0.17%
Foreign equities	-0.98%	-0.36%	-0.15%	-1.49%
Total assets	-2.33%	0.36%	0.23%	-1.74%

Remark: Delta between total effects are due to compounding.

Example – Step 4 (Assigning of (excess) returns) (2/2)

	Asset allocation effect	Stock picking effect	Interaction effect	Total management effects
Domestic bonds	-0.20%	0.61%	0.00%	0.41%



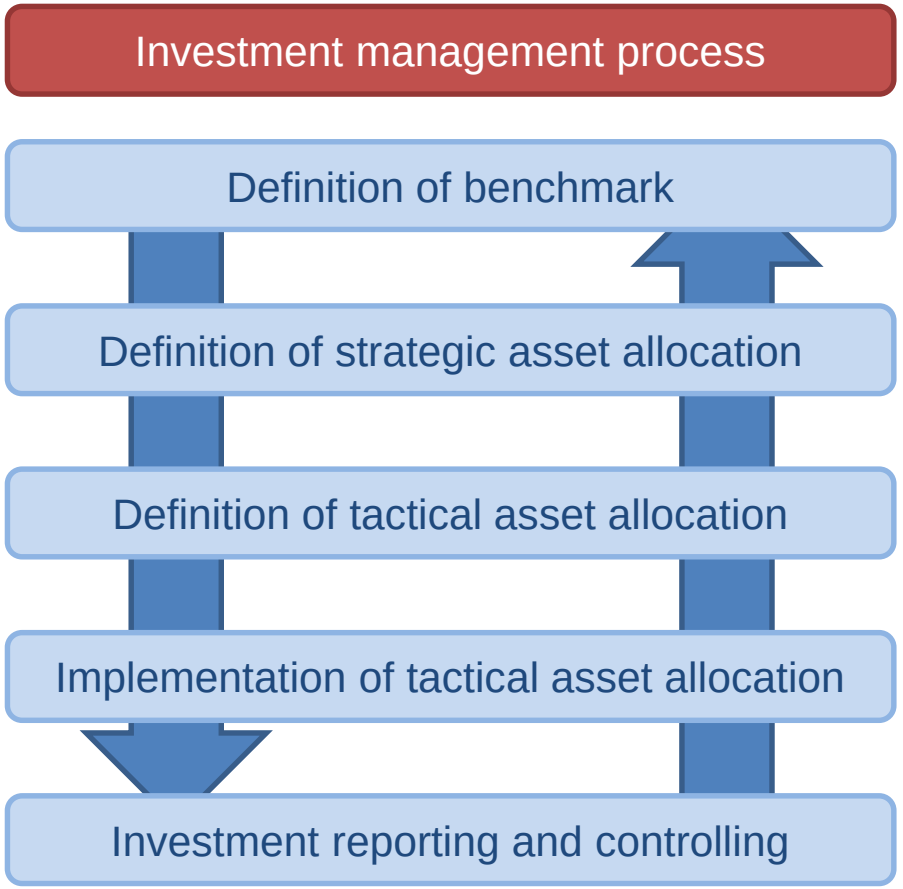
	Board of directors	Investment committee	Portfolio manager	Total management effects
Domestic bonds	-0.25%	0.48%	0.17%	0.41%
	Definition of benchmark versus target return	SAA and TAA weights and choice of portfolio index	Effective portfolio weights and stock picking	!

General framework for decision-oriented risk attribution

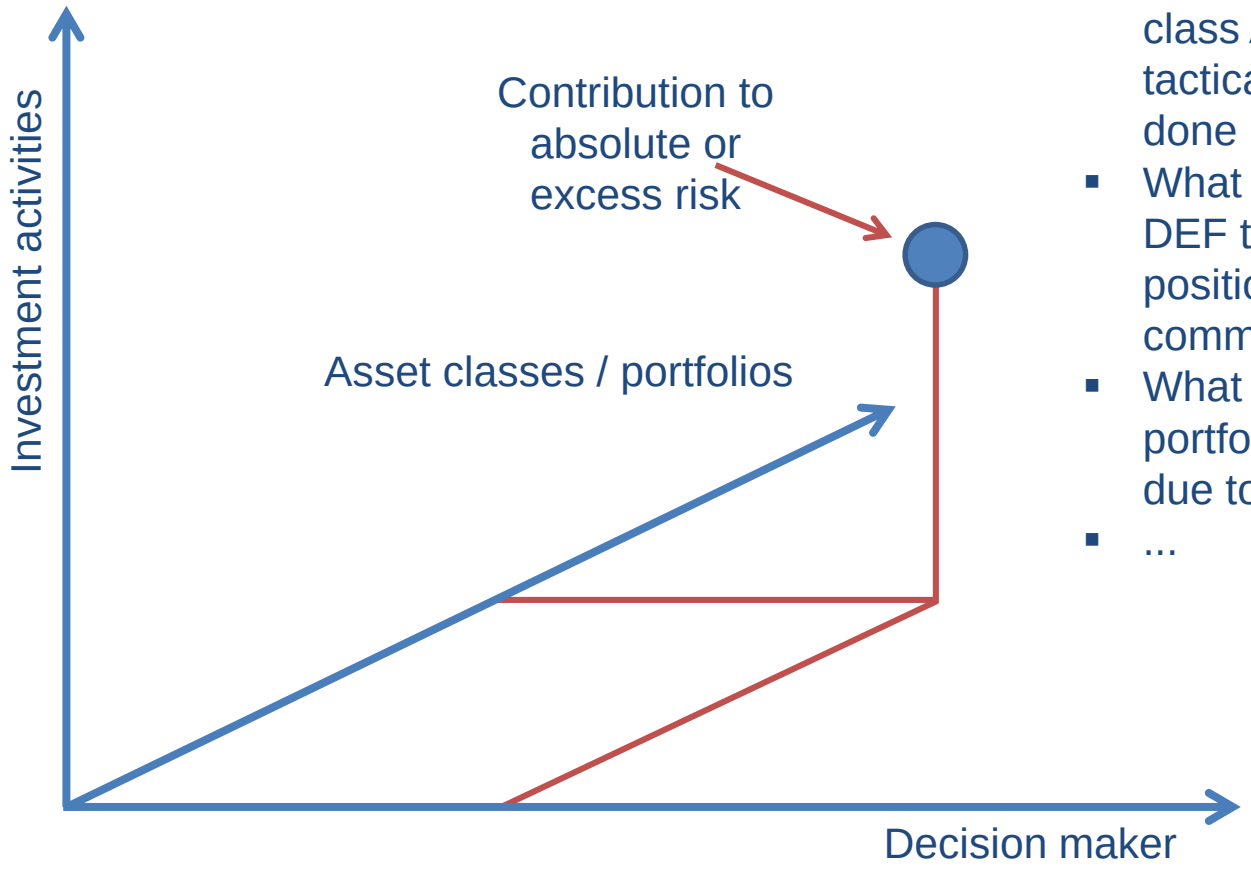
Definition – Decision-oriented risk attribution

Decision-oriented risk attribution is the decomposition of the absolute or excess risk of an investment portfolio according to specific investment decisions done by specific decision makers.

The decomposition approach is difficult to standardize and therefore normally tailor-made as the relevant investment management processes differ – sometimes substantially.



Aspects addressed and clarified



- What is the contribution of the asset class ABC to excess risk due to tactical asset allocation decisions done by the investment committee.
- What is the contribution of portfolio DEF to absolute risk due to portfolio positioning done by the investment committee.
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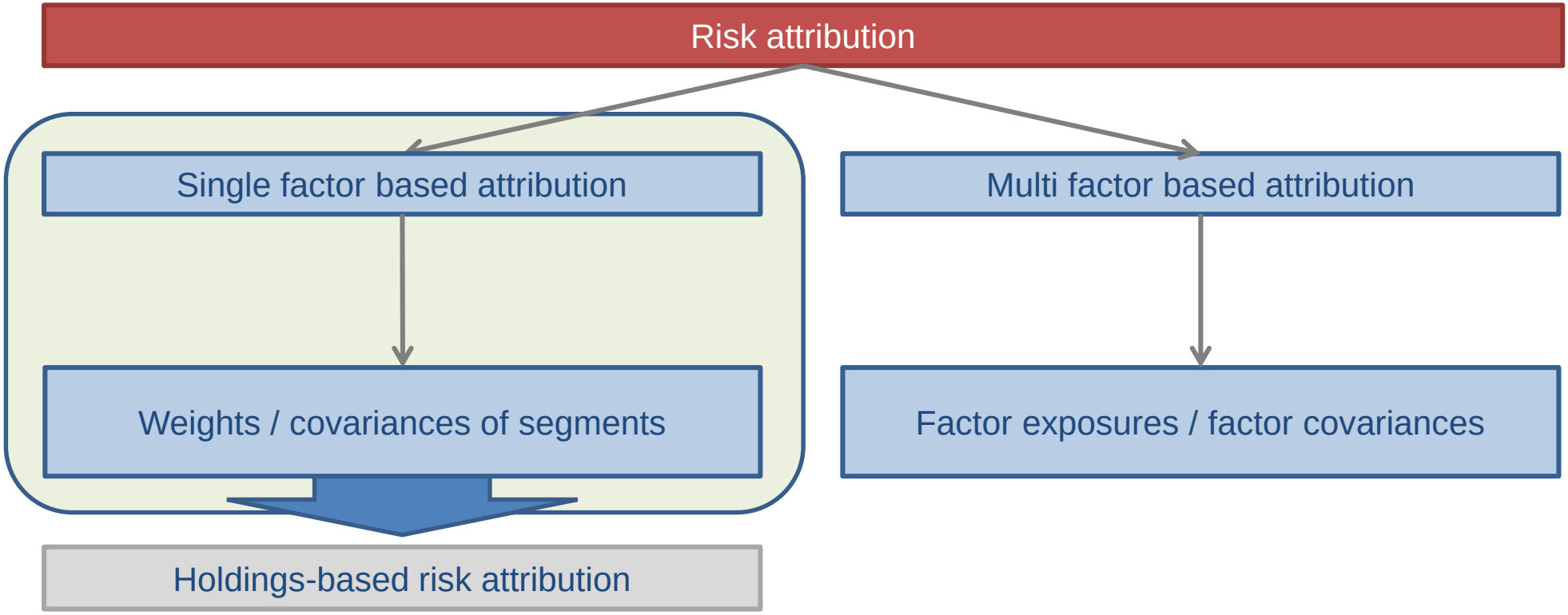
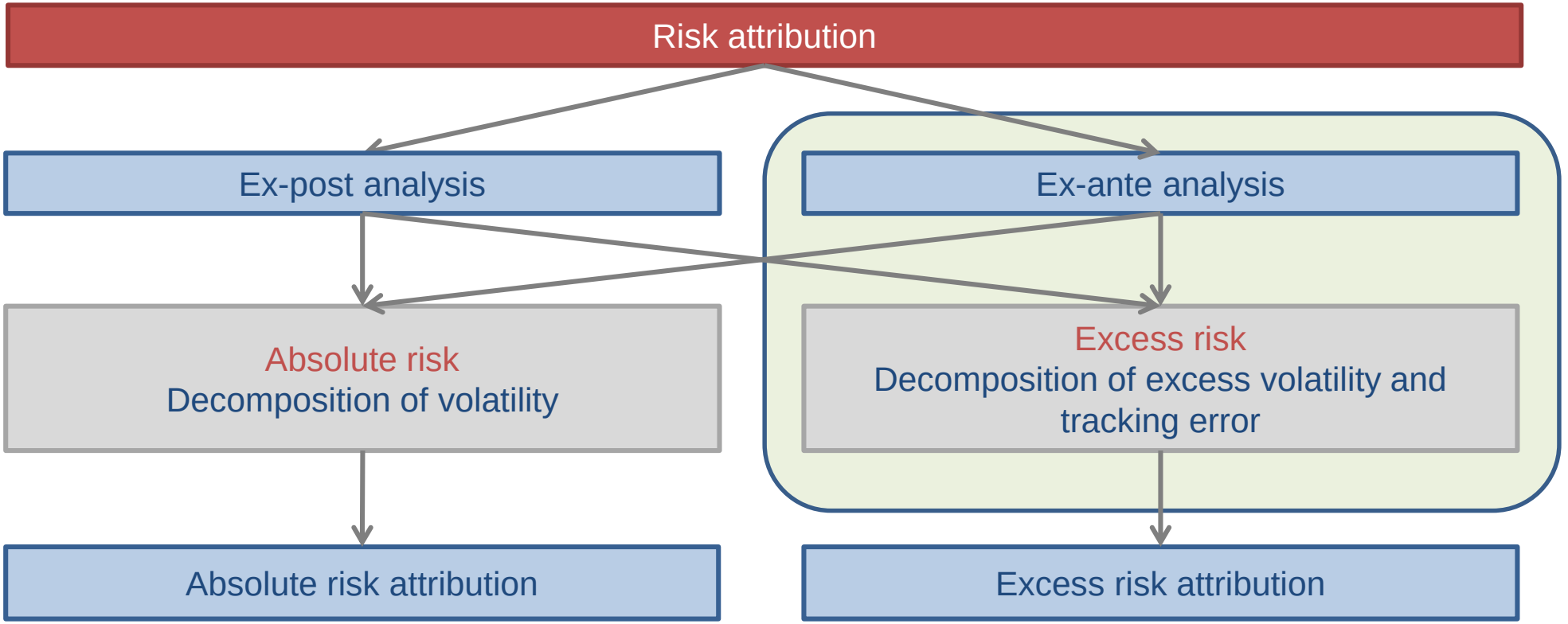
- ...

Risk attribution - The big picture (1/2)



Risk attribution - The big picture (2/2)



Remark: Lot of other (statistical) risk measures can be considered. In the following we focus on variance and volatility.

Generic decomposition approach (1/2)

Decision-oriented decomposition of the absolute (excess) risk allows to quantify the risk contribution or the value added of the individual decision makers and is based on the following steps:

- Step 1: Identify the circumstances, the investment management setup, and derive relevant assumptions for calculation.
- Step 2: Mirror the specific investment decisions into (absolute) asset allocations.
- Step 3: Calculate the corresponding risk figures.
- Step 4: Assign the absolute risk as well as the risk differences to the investment decisions and to the relevant decision makers.

Example – Step 1 (Investment process) (1/2)

Analyze the circumstances or characteristics relevant for the investment portfolio:

- Decision makers:
  - Board of directors.
  - Investment committee.
  - Portfolio managers.
- Monthly revolving investment management process.
- Investment portfolio invests in four asset classes:
  - Domestic bonds.
  - Foreign bonds.
  - Domestic equities.
  - Foreign equities.

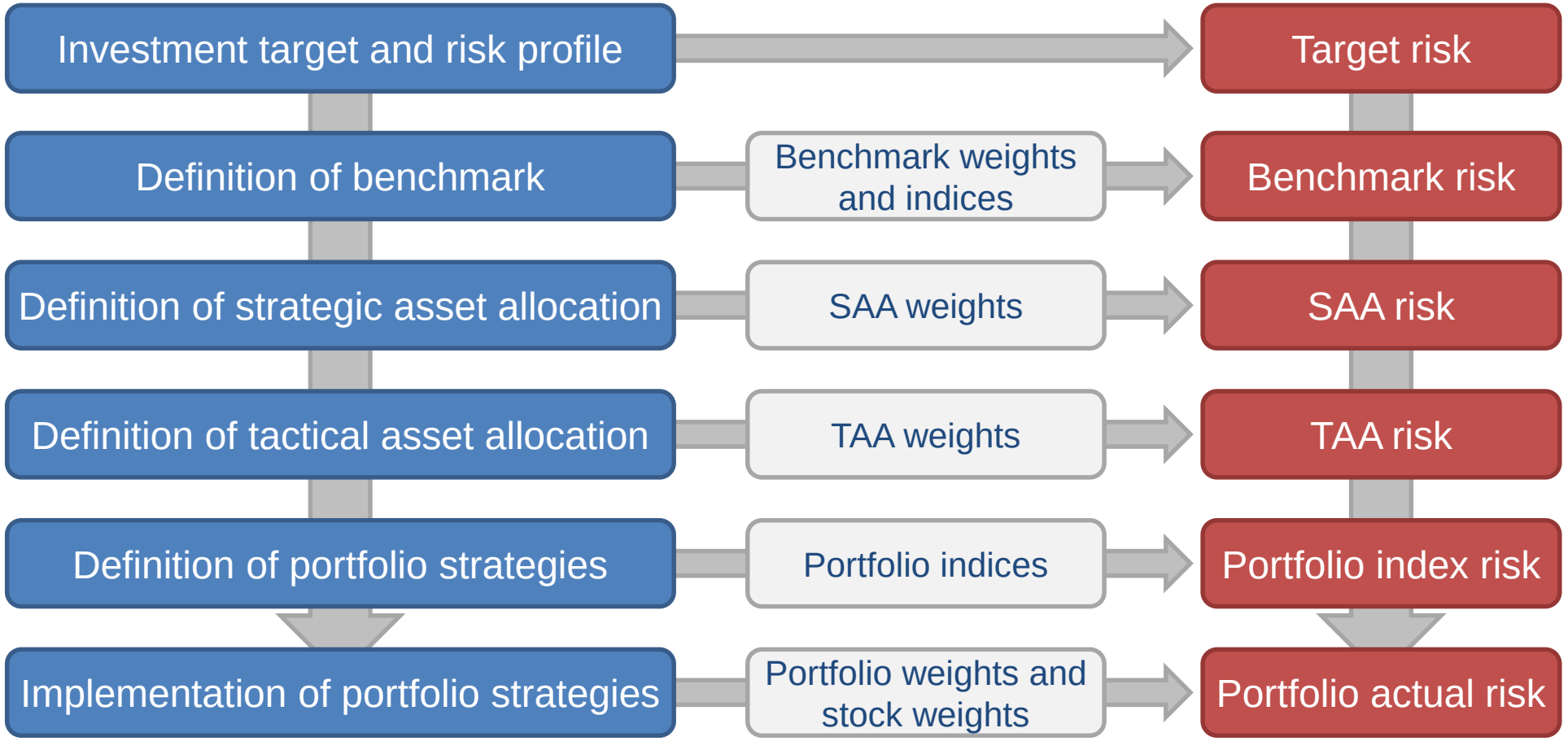
Example – Step 1 (Investment process) (2/2)

- Investments are managed through eight sub-portfolios – two for each asset class.
- No specific investment restrictions to be considered.
- 5 step investment management process:
  - Definition of benchmark.
  - Definition of strategic asset allocation.
  - Definition of tactical asset allocation.
  - Definition of portfolio strategies.
  - Implementation of portfolio strategies.

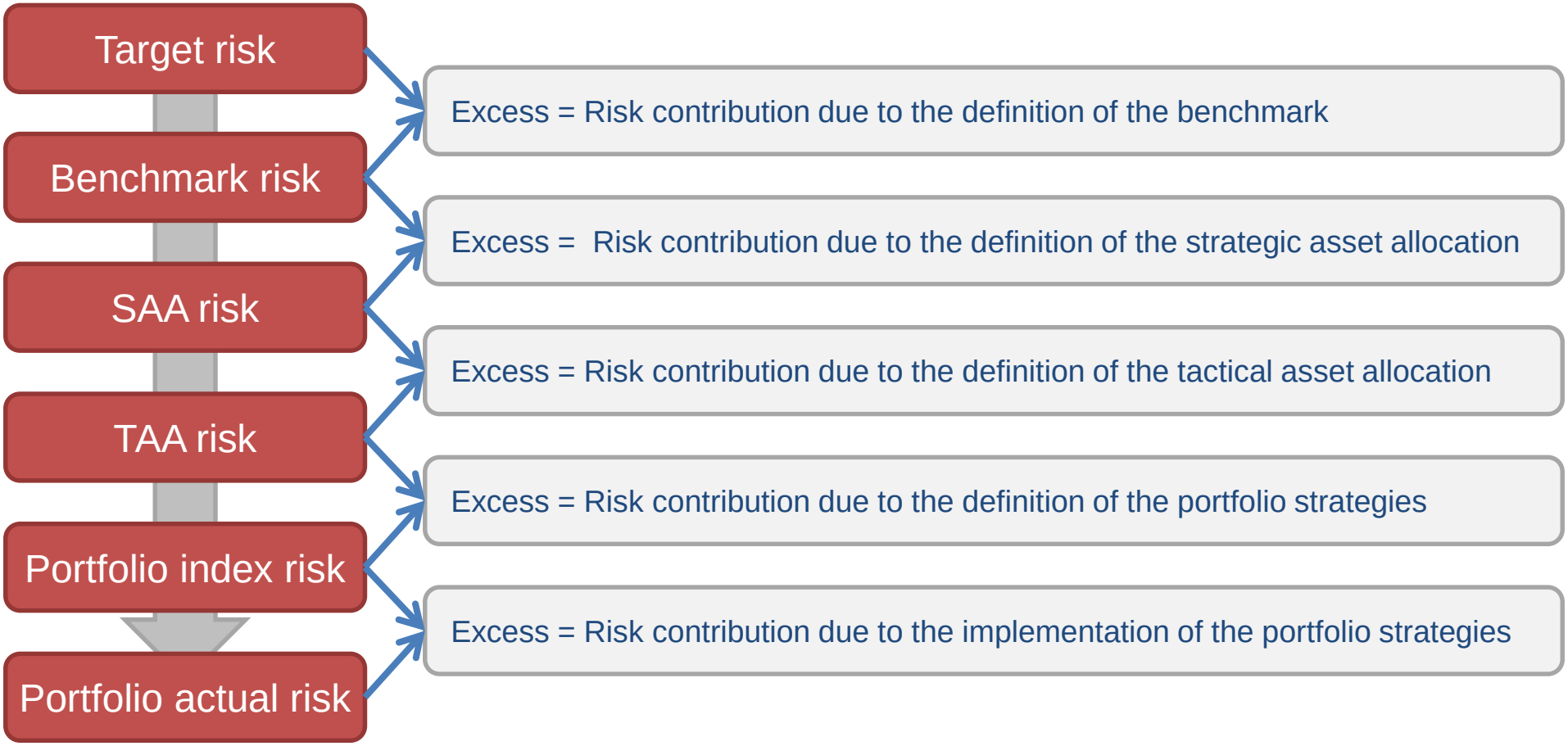
Example – Step 2 (Mirror investment decisions)

Weights	Benchmark	Strategic asset allocation	Tactical asset allocation	Portfolio strategies allocation	Actual portfolio allocation
Domestic bonds	10.00%	10.00%	10.00%	10.00%	12.00%
Foreign bonds	20.00%	10.00%	25.00%	25.00%	23.00%
Domestic equities	30.00%	35.00%	55.00%	55.00%	55.00%
Foreign equities	40.00%	45.00%	10.00%	10.00%	10.00%
Total assets	100.00%	100.00%	100.00%	100.00%	100.00%

Example – Step 3 (Calculation of risk figures) (1/4)



Example – Step 3 (Calculation of risk figures) (2/4)

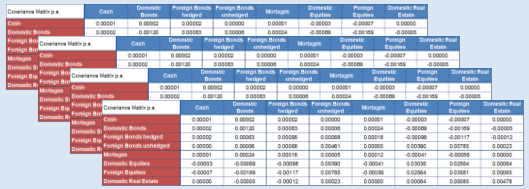


Example – Step 3 (Calculation of risk figures) (3/4)

Weights	Benchmark	Strategic asset allocation	Tactical asset allocation	Portfolio strategies	Implementation
Domestic Bonds 1	5.00%	5.00%	5.00%	5.00%	5.00%
Domestic Bonds 2	5.00%	5.00%	5.00%	5.00%	7.00%
Foreign Bonds 1	4.00%	2.00%	5.00%	5.00%	5.00%
Foreign Bonds 2	16.00%	8.00%	20.00%	20.00%	18.00%
Domestic Equities 1	13.64%	15.91%	25.00%	25.00%	25.00%
Domestic Equities 2	16.36%	19.09%	30.00%	30.00%	30.00%
Foreign Equities 1	20.00%	22.50%	5.00%	5.00%	5.00%
Foreign Equities 2	20.00%	22.50%	5.00%	5.00%	5.00%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

Volatilities	Benchmark	Strategic asset allocation	Tactical asset allocation	Portfolio strategies	Implementation
Domestic Bonds 1	0.30%	0.30%	0.30%	0.31%	0.35%
Domestic Bonds 2	3.47%	3.47%	3.47%	2.99%	2.57%
Foreign Bonds 1	3.08%	3.08%	3.08%	3.02%	3.21%
Foreign Bonds 2	6.79%	6.79%	6.79%	6.34%	6.00%
Domestic Equities 1	1.08%	1.08%	1.08%	0.87%	0.78%
Domestic Equities 2	17.42%	17.42%	17.42%	17.58%	17.76%
Foreign Equities 1	18.92%	18.92%	18.92%	18.78%	18.69%
Foreign Equities 2	6.91%	6.91%	6.91%	3.37%	1.21%
Total	7.05%	7.64%	6.59%	6.55%	6.47%

Lot of covariance matrixes are needed



Example – Step 3 (Calculation of risk figures) (4/4)

Target risk
7.50%

-

Portfolio actual risk
6.47%

Surplus risk for the investment portfolio => **- 1.03%**

= Risk contribution due to benchmark definition => **- 0.45%**

+ Risk contribution due to strategic asset allocation => **+ 0.59%**

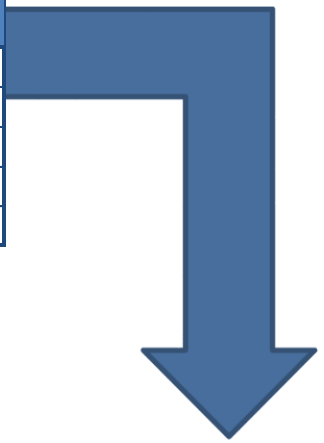
+ Risk contribution due to tactical asset allocation => **-1.05%**

+ Risk contribution due to portfolio strategies => **- 0.04%**

+ Risk contribution due to implementation => **- 0.08%**

Example – Step 4 (Assigning of (excess) risk figures) (1/2)

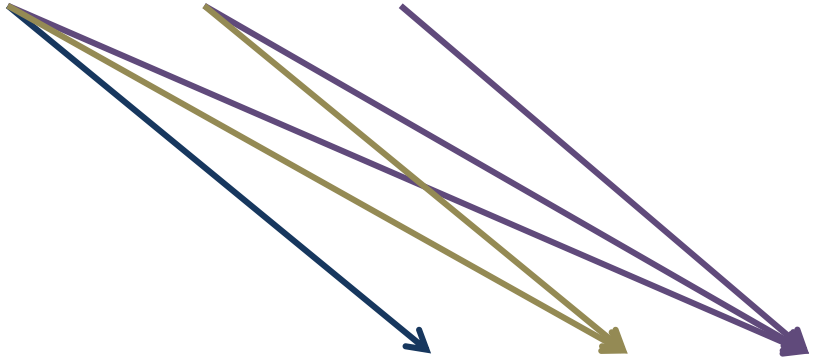
Management effects to excess risk	Asset allocation effect	Stock picking effect	Interaction effect	Total effects
Domestic Bonds	0.00%	0.01%	0.00%	0.00%
Foreign Bonds	-0.10%	-0.07%	0.01%	-0.09%
Domestic Equities	-0.76%	-0.02%	0.07%	-0.82%
Foreign Equities	-0.13%	-0.28%	0.24%	-0.13%
Total assets	-0.99%	-0.36%	0.32%	-1.03%



Management effects to excess risk	Board of directors	Investment committee	Portfolio manager	Total effects
Domestic Bonds	0.00%	0.01%	0.00%	0.00%
Foreign Bonds	-0.04%	-0.02%	-0.07%	-0.09%
Domestic Equities	-0.16%	1.15%	0.01%	-0.82%
Foreign Equities	-0.25%	-1.64%	-0.02%	-0.13%
Total assets	-0.45%	-0.50%	-0.08%	-1.03%

Example – Step 4 (Assigning of (excess) returns) (2/2)

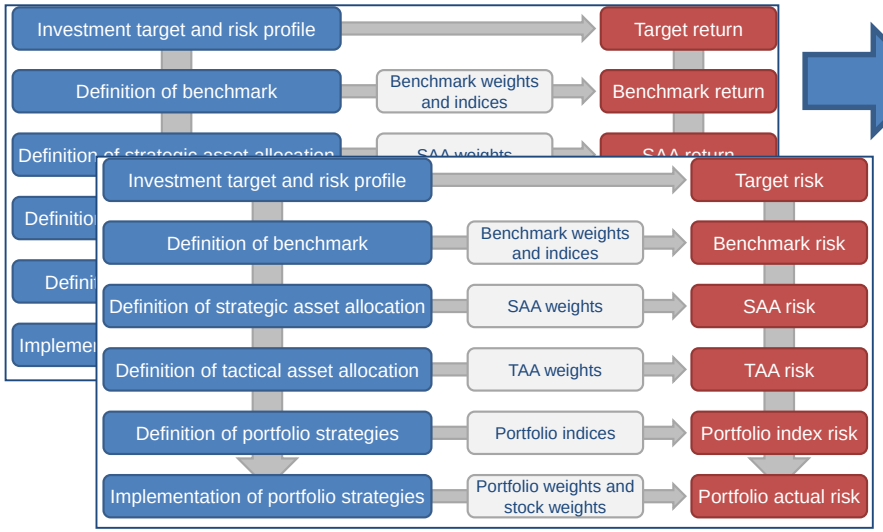
Management effects to excess risk	Asset allocation effect	Stock picking effect	Interaction effect	Total effects
Domestic Equities	-0.76%	-0.02%	0.07%	-0.82%

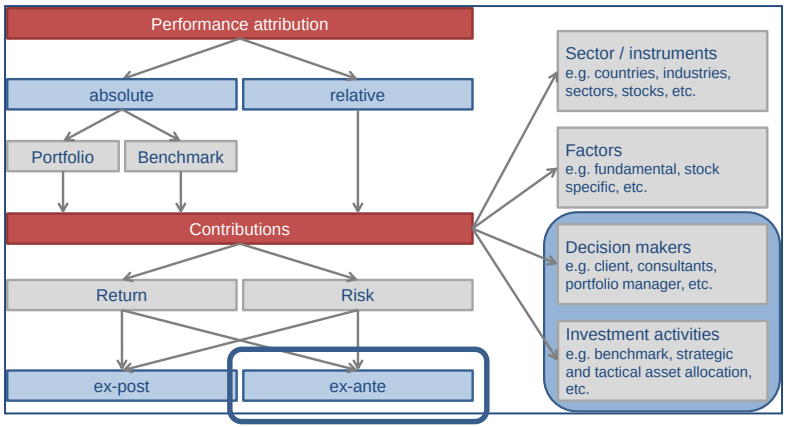


Management effects to excess risk	Board of directors	Investment committee	Portfolio manager	Total effects
Domestic Equities	-0.16%	1.15%	0.01%	-0.82%
	Definition of benchmark versus target risk	SAA and TAA weights and choice of portfolio index	Effective portfolio weights and stock picking	!

Thoughts on combining return and risk attribution for multi-layer investment processes

Comprehensive performance attribution – An example (1/4)





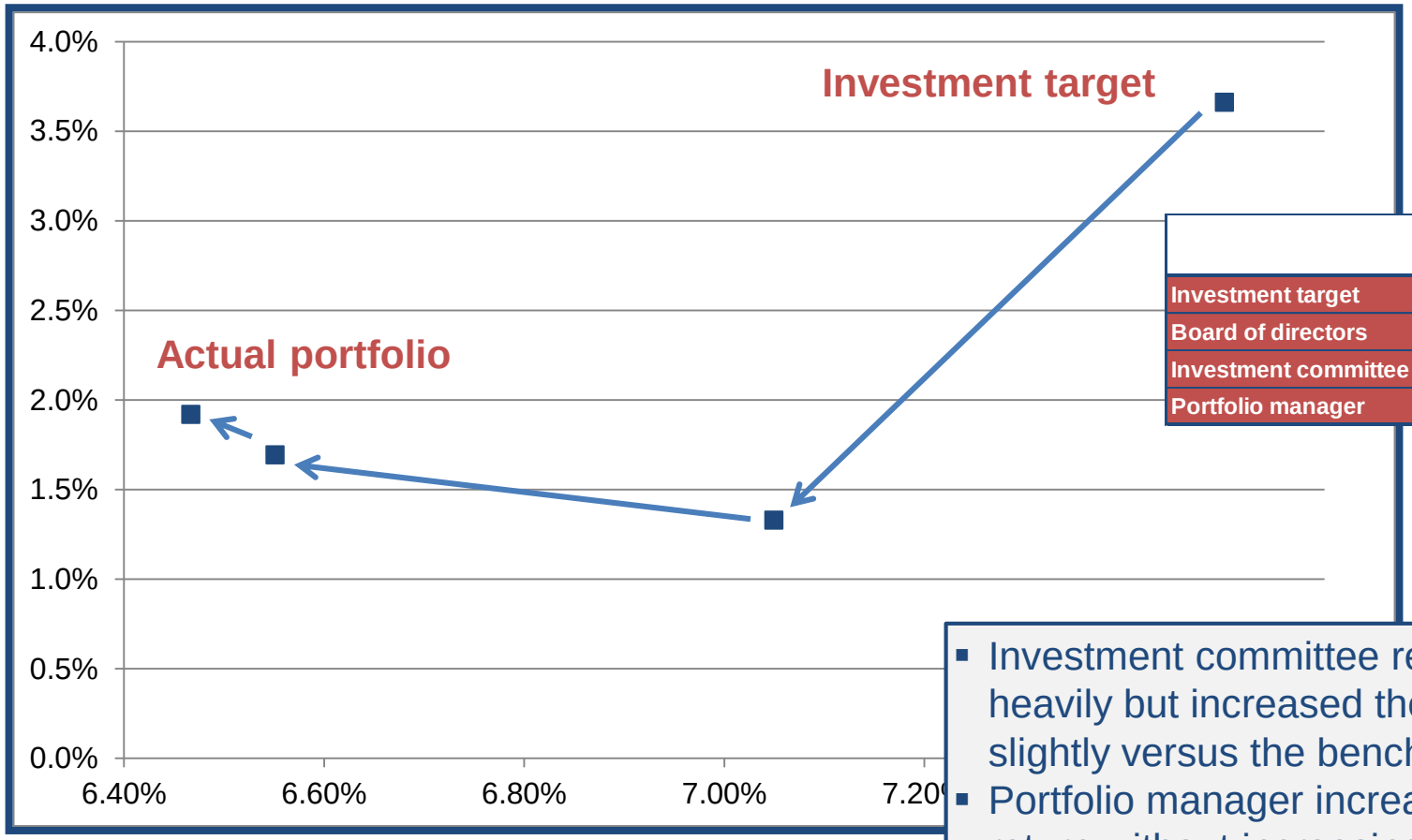
	Expected Risk	Expected Return
Investment target	7.50%	3.66%
Board of directors	7.05%	1.33%
Investment committee	6.55%	1.69%
Portfolio manager	6.47%	1.92%

	Expected Risk	Expected Return
Investment target	7.50%	3.66%
Benchmark	7.05%	1.33%
Strategic asset allocation	7.64%	1.27%
Tactical asset allocation	6.59%	1.36%
Portfolio strategies	6.55%	1.69%
Actual portfolio	6.47%	1.92%

How much absolute or excess risk is coming from each asset class, each decision and each decision maker?
And what where the consequences on the **expected** return?

Interpretations.

Comprehensive performance attribution – An example (2/4)

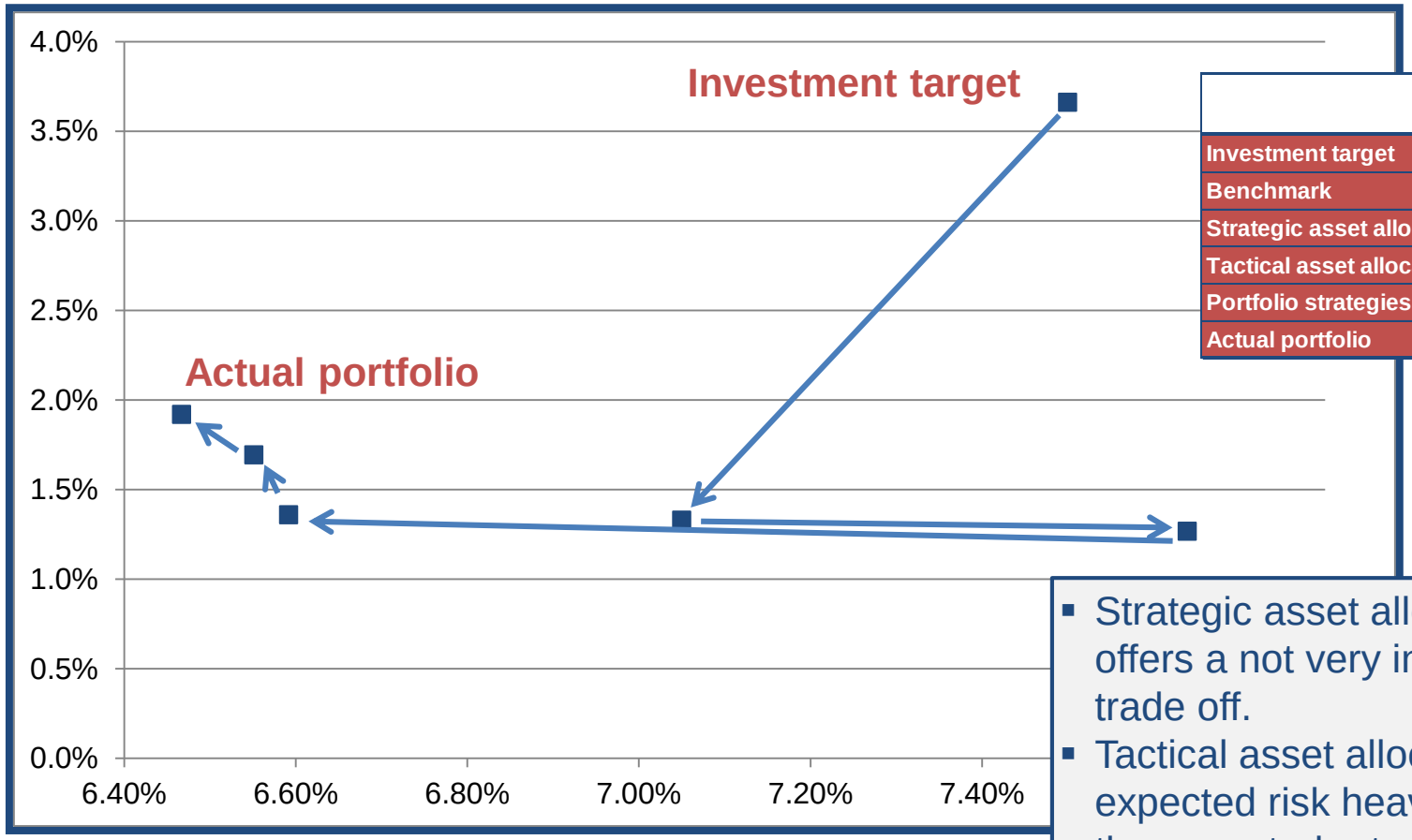


	Expected Risk	Expected Return
Investment target	7.50%	3.66%
Board of directors	7.05%	1.33%
Investment committee	6.55%	1.69%
Portfolio manager	6.47%	1.92%

- Investment committee reduced the risk profile heavily but increased the expected return slightly versus the benchmark.
- Portfolio manager increased the expected return without increasing the expected risk.
- ...

=> Decision-route to the actual portfolio

Comprehensive performance attribution – An example (3/4)

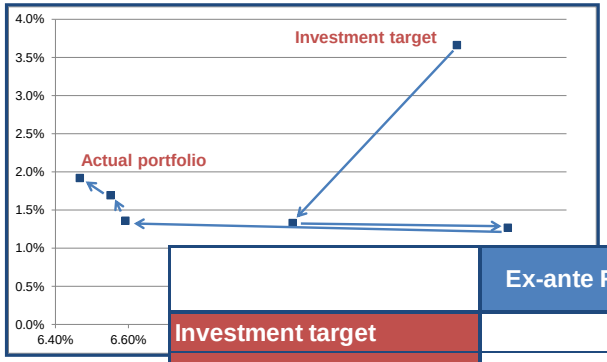


	Expected Risk	Expected Return
Investment target	7.50%	3.66%
Benchmark	7.05%	1.33%
Strategic asset allocation	7.64%	1.27%
Tactical asset allocation	6.59%	1.36%
Portfolio strategies	6.55%	1.69%
Actual portfolio	6.47%	1.92%

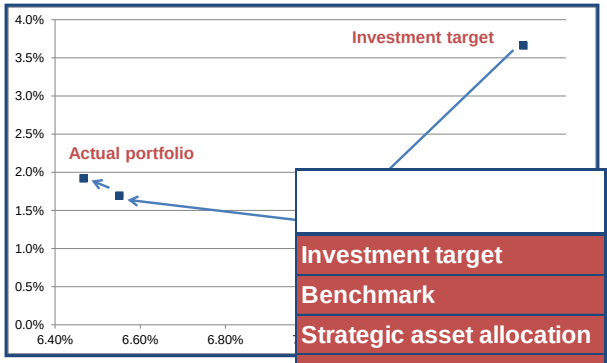
- Strategic asset allocation currently offers a not very interesting risk/return trade off.
- Tactical asset allocation reduced the expected risk heavily without reducing the expected return.
- ...

=> Decision-route to the actual portfolio

Comprehensive performance attribution – An example (4/4)

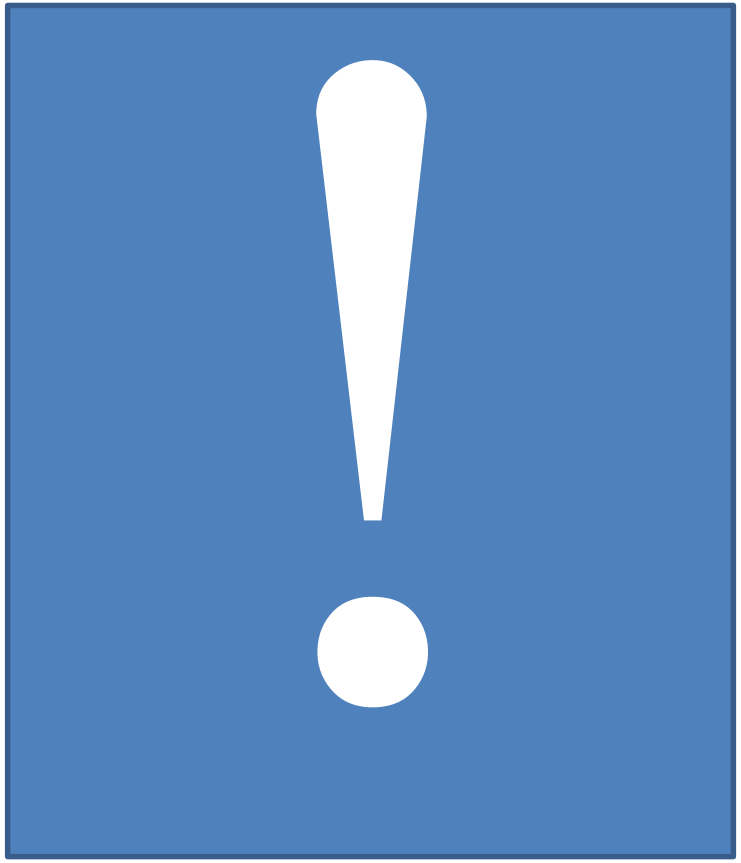


	Ex-ante Return/Risk Ratio
Investment target	0.49
Board of directors	0.19
Investment committee	0.26
Portfolio manager	0.30



	Ex-ante Return/Risk Ratio
Investment target	0.49
Benchmark	0.19
Strategic asset allocation	0.17
Tactical asset allocation	0.21
Portfolio strategies	0.26
Actual portfolio	0.30

Comments and questions



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