

DECOMPOSING MONEY-WEIGHTED RATE OF RETURN

Dr. Stefan Illmer
CREDIT SUISSE ASSET MANAGEMENT

Performance Attribution Roundtable
Zurich, 25th of February 2004

DECOMPOSING MWR

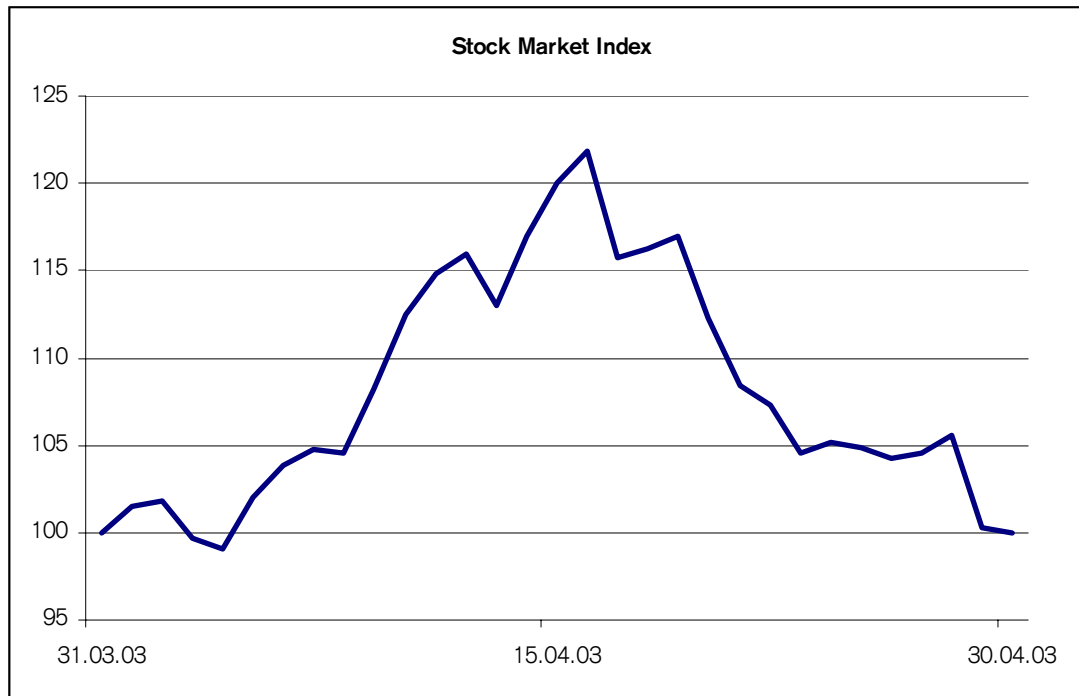
AGENDA

- INTRODUCTION / INITIAL COMMENTS
- AN INTUITIVE APPROACH
- A MORE DETAILED APPROACH – ON TOTAL PORTFOLIO LEVEL
- A MORE DETAILED APPROACH – ON ASSET CLASS LEVEL
- CONCLUSION

INTRODUCTION / INITIAL COMMENTS

DECOMPOSING MWR

INTRODUCTION



What is return of the stock market index or of an index portfolio manager? => **0%**

What is the return of a client who doubled the money invested in the middle of the period? => **-11%**

DECOMPOSING MWR

INITIAL COMMENTS ON TWR

Time-Weighted Rate of Return (TWR) measures the return of a portfolio in a way that the return is ***insensitive*** to changes in the money invested in the portfolio

- => TWR measures the return from a portfolio manager's perspective if he does not have control over the (external) cash flows
- => TWR allows a comparison against a benchmark and across peer groups
- => Calculating, decomposing and reporting TWRs is common practice in the asset management industry
- => Presenting TWRs is one of the key principles of the GIPS Standards

DECOMPOSING MWR

INITIAL COMMENTS ON MWR

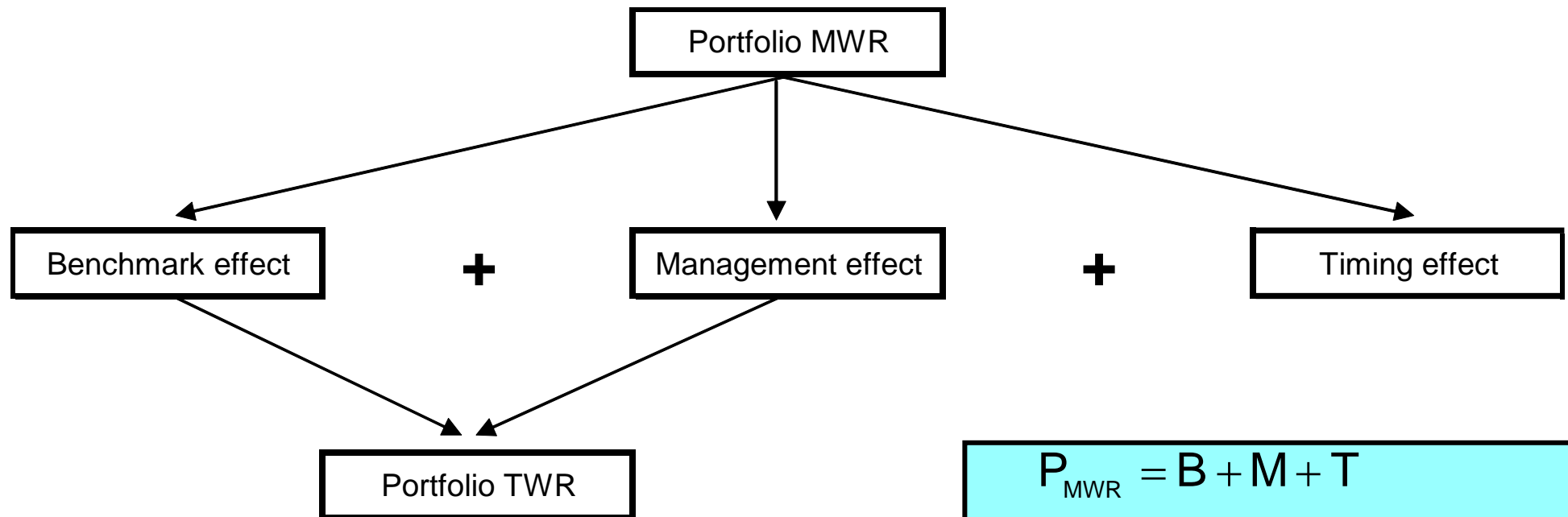
Money-Weighted Rate of Return (MWR) measures the return of a portfolio in a way that the return is **sensitive** to changes in the money invested in the portfolio

- => MWR measures the return from a client's perspective where he does have control over the (external) cash flows
- => MWR does not allow a comparison against a benchmark and across peer groups because MWRs are usually client specific
- => Calculating, decomposing and reporting MWRs is not common practice in the asset management industry
- => MWRs are not covered by the GIPS Standards
- => *Decomposing MWR is not addressed by the performance attribution software vendors !*

AN INTUITIVE APPROACH

DECOMPOSING MWR

AN INTUITIVE APPROACH (1/2)



$$\begin{aligned}
 P_{MWR} &= B + M + T \\
 (1) \quad &= B_{TWR} + TWR_{active} + T \\
 &= P_{TWR} + T
 \end{aligned}$$

P_{MWR}	= Portfolio MWR ("True" MWR)	B	= Benchmark effect
P_{TWR}	= Portfolio TWR ("True" TWR)	M	= Management effect = TWR_{active}
B_{TWR}	= Benchmark TWR	T	= Timing effect

DECOMPOSING MWR

AN INTUITIVE APPROACH (2/2)

Decomposing MWR according to the most important investment decisions from a client's point of view

- **benchmark effect** => contribution due to the decision to invest the initial money into a specific benchmark strategy and which is equal to the benchmark return over the investment period
- **management effect** => contribution due to the decision to change the asset allocation and stock selection of the portfolio relative to the benchmark over the investment period, and
- **timing effect** => contribution due to the decision to change the money invested in the benchmark strategy and in the active asset allocation of the portfolio over the investment period

DECOMPOSING MWR

AN EXAMPLE (1/4)

- Time period is one month (31.03. until 30.04.)
- Discretionary balanced account investing in three asset classes: equities, bonds and cash
- Portfolio manager does an active asset allocation decision at the beginning of the month and changes it on the 15.04.
- Benchmark is rebalanced at month end

Asset class	Asset allocation benchmark as of 31.03.	Asset allocation portfolio as of 31.03.	Asset allocation portfolio as of 15.04. (after adjustments and cash flow)
Equities	30.0%	50.0%	40.0%
Bonds	60.0%	45.0%	55.0%
Cash	10.0%	5.0%	5.0%

DECOMPOSING MWR

AN EXAMPLE (2/4)

- Portfolio manager invests only in index funds which have an active return of zero => no stock picking
- The indices and the index funds have the following returns

Indices and index funds	Return for the period 31.03. until 15.04.	Return for the period 15.04. until 30.04.	Return for the period 31.03. until 30.04.
Equities	3.00%	15.00%	18.45%
Bonds	2.00%	1.00%	3.02%
Cash	0.50%	0.50%	1.00%

- Management fees, transaction costs and other fees are not considered
- Client increase the assets from CHF 1'000 at the beginning at the month by CHF 500 in the middle of the month (15.04.)

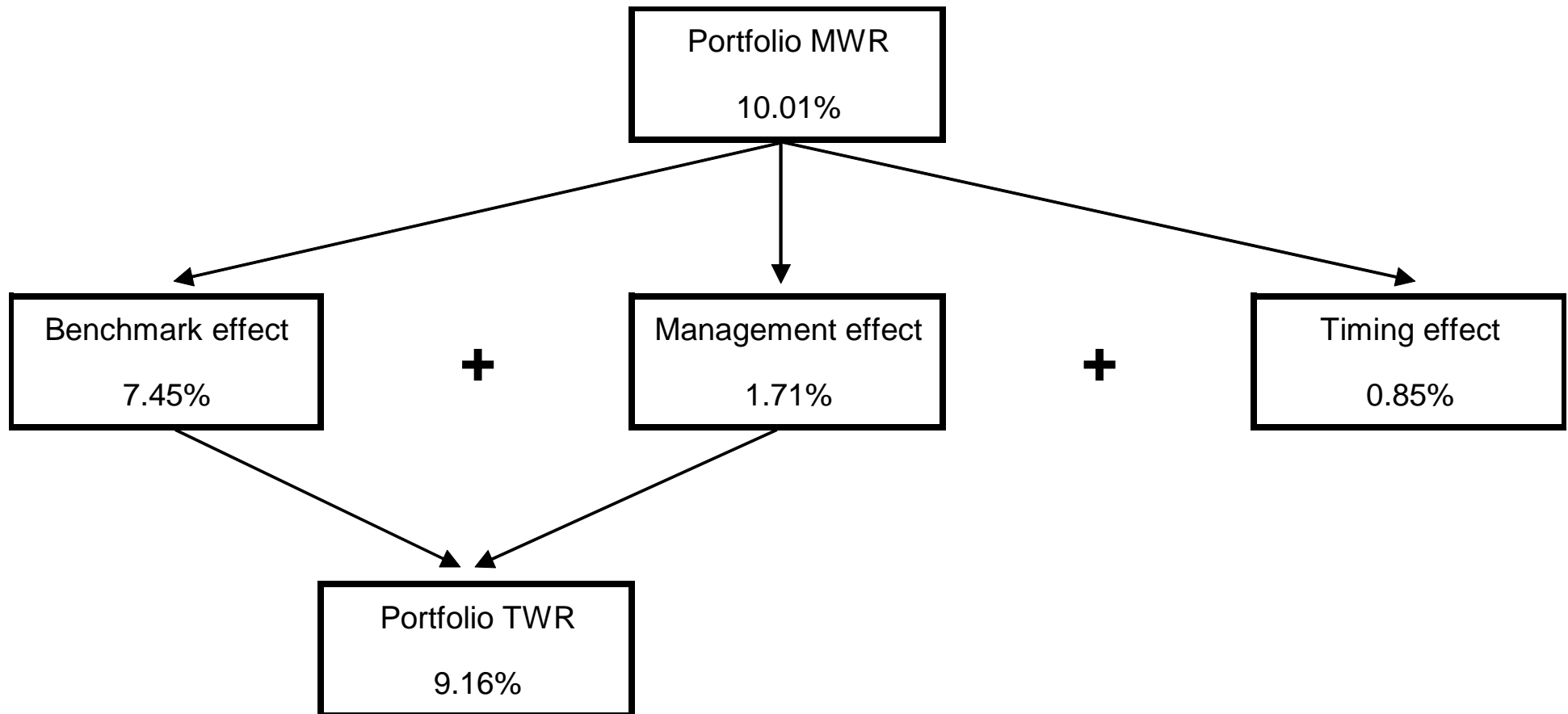
DECOMPOSING MWR

AN EXAMPLE (3/4)

- MWR is a “true” MWR and is calculated using the Internal Rate of Return Method (IRR)
- TWR is a “true” TWR using a portfolio revaluation on the 15.04. and geometrical linking of the returns of the two sub-periods

DECOMPOSING MWR

AN EXAMPLE (4/4)



A MORE DETAILED APPROACH - ON TOTAL PORTFOLIO LEVEL

DECOMPOSING MWR

A MORE DETAILED APPROACH

A decision oriented framework allows a further decomposition of the MWR and may be based on the following steps:

- **Step 1:** to mirror the specific investment decisions into (absolute) asset allocations
- **Step 2:** to calculate the corresponding returns
- **Step 3:** to assign the returns as well as the return differences to the investment decisions as well as to the relevant decision makers

DECOMPOSING MWR

STEP 1: DEFINE THE DECISIONS MADE?

- **Decision 1:** Investing the initial money into the benchmark
- **Decision 2:** Changing the asset allocation at the beginning of the period
- **Decision 3:** Changing the asset allocation in the middle of the month
- **Decision 4:** Investing additional money into the benchmark in the middle of the month
- **Decision 5:** Investing additional money into the asset allocation decision in the middle of the month
- **Decision 6:** Investing additional money into the changed asset allocation decision in the middle of the month

DECOMPOSING MWR

STEP 2: TRANSFER THE DECISIONS INTO STRATEGIES AND CALCULATE THEIR RETURNS

Strategy	Active asset allocation on the 31.03.	Cash inflow on the 15.04.	Changed asset allocation on the 15.04.	Return
1	Benchmark MWR			7.45%
1	Benchmark TWR			7.45%
1	Portfolio MWR			7.45%
1	Portfolio TWR			7.45%
2	Benchmark MWR	x		7.45%
2	Benchmark TWR	x		7.45%
2	Portfolio MWR	x		10.63%
2	Portfolio TWR	x		10.63%
3	Benchmark MWR	x	x	7.45%
3	Benchmark TWR	x	x	7.45%
3	Portfolio MWR	x	x	9.16%
3	Portfolio TWR	x	x	9.16%
4	Benchmark MWR		x	8.06%
4	Benchmark TWR		x	7.45%
4	Portfolio MWR		x	8.06%
4	Portfolio TWR		x	7.45%
5	Benchmark MWR	x	x	8.06%
5	Benchmark TWR	x	x	7.45%
5	Portfolio MWR	x	x	11.78%
5	Portfolio TWR	x	x	10.63%
6	Benchmark MWR	x	x	8.06%
6	Benchmark TWR	x	x	7.45%
6	Portfolio MWR	x	x	10.01%
6	Portfolio TWR	x	x	9.16%

DECOMPOSING MWR

STEP 3A: ASSIGN DECISIONS TO THE DECISION MAKERS

Client: Decision 1, 4, 5, 6

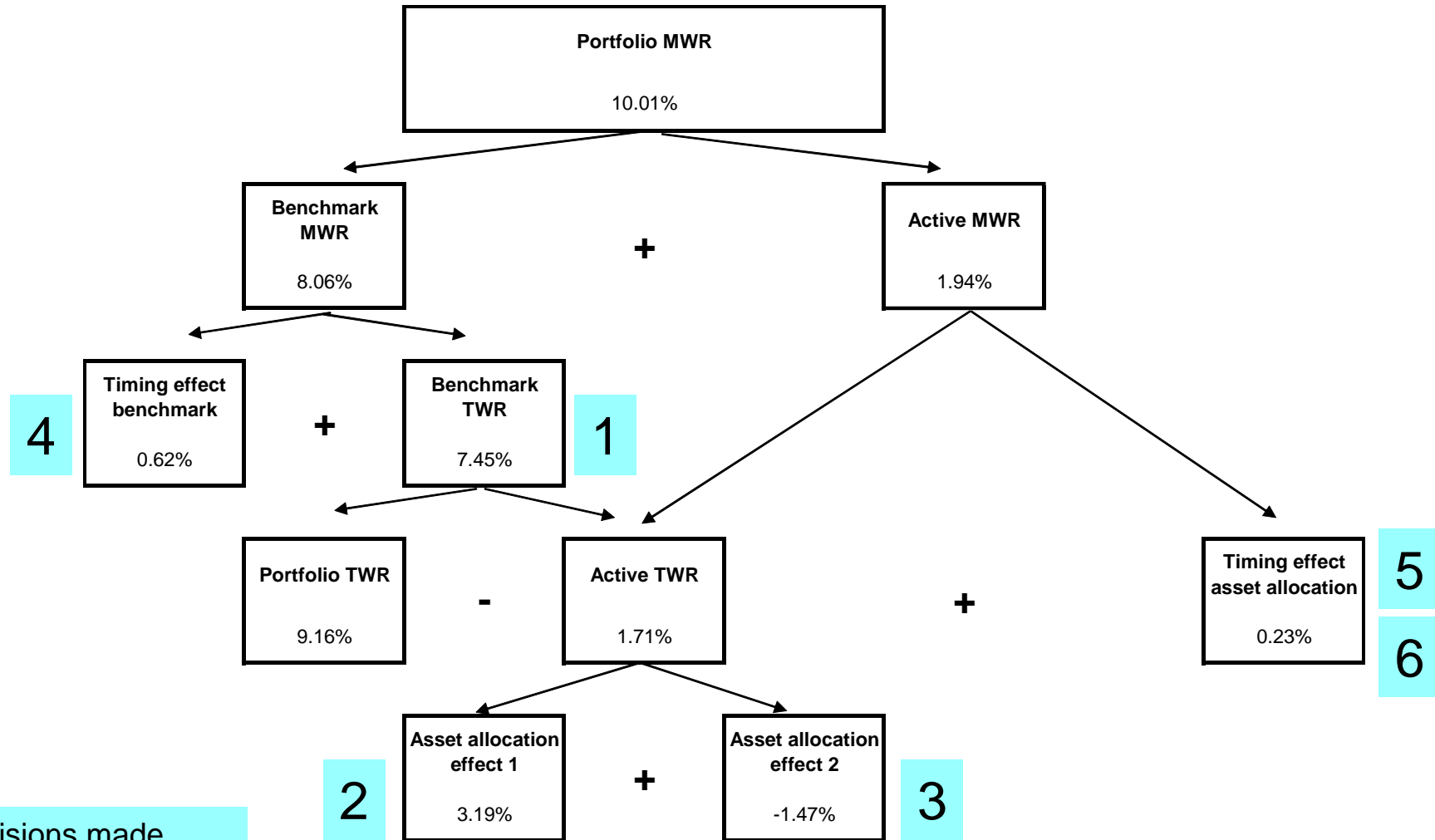
- Decision 1 reflects the benchmark return (without the impact of cash flows)
- Decision 4 to 6 reflect the timing effects of investing or withdrawing money

Portfolio Manager: Decision 2 and 3 (=> in case of discretionary asset management accounts)

- Decision 2 and 3 reflect the asset allocation effects (without the impact of cash flows)

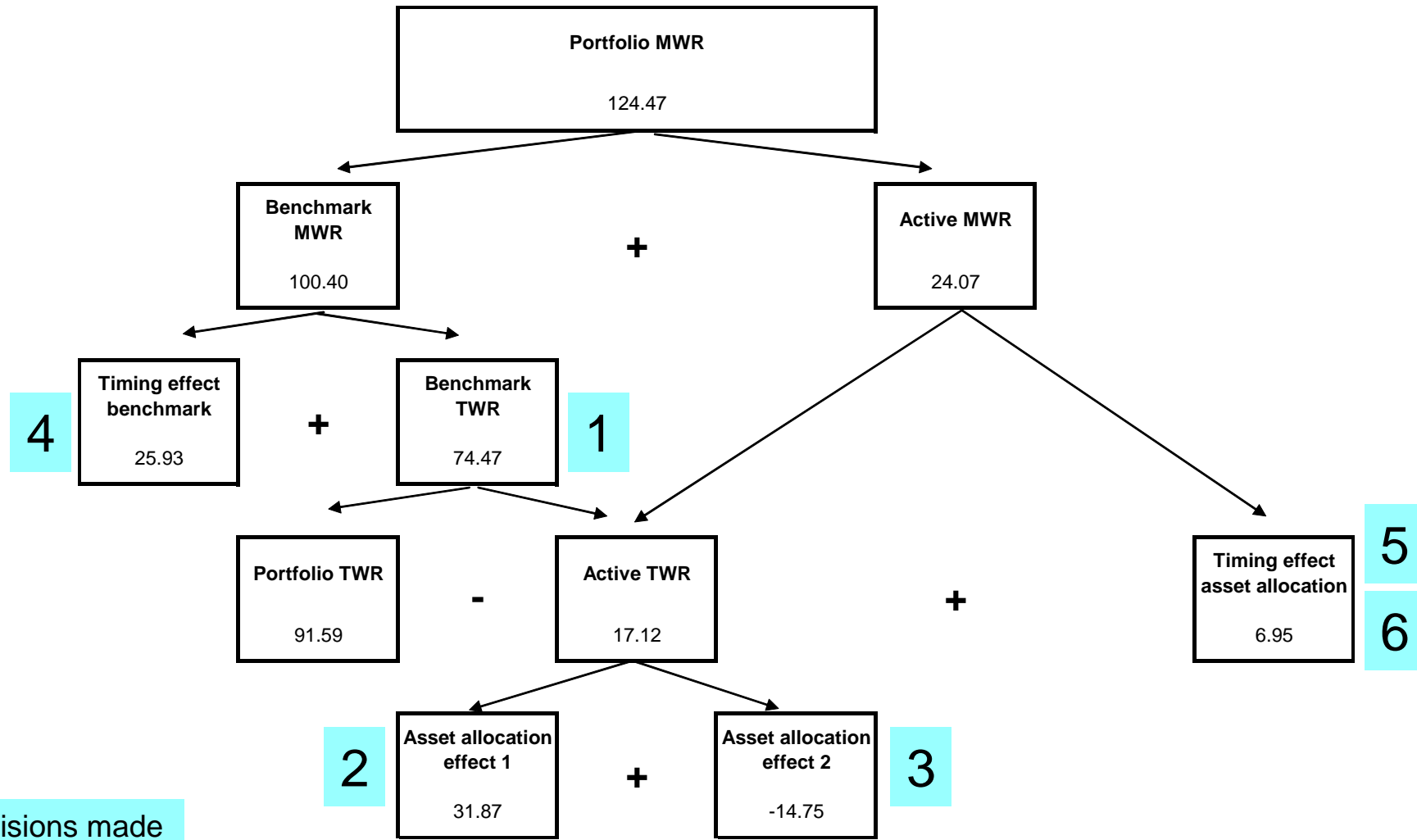
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STEP 3B: CALCULATE THE RETURN CONTRIBUTIONS



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STEP 3C: CALCULATE PROFIT & LOSS CONTRIBUTIONS



DECOMPOSING MWR

SOME FORMULAS FOR TOTAL LEVEL ANALYSIS

$$\begin{aligned}
 (1) \quad MWR_{\text{active}} &= P_{\text{MWR}} - B_{\text{MWR}} \\
 &= TWR_{\text{active}} + T_A \\
 (2) \quad TWR_{\text{active}} &= P_{\text{TWR}} - B_{\text{TWR}} \\
 (3) \quad T_A &= (P_{\text{MWR}} - B_{\text{MWR}}) - (P_{\text{TWR}} - B_{\text{TWR}}) \\
 (4) \quad T_B &= B_{\text{MWR}} - B_{\text{TWR}} \\
 (5) \quad T &= T_A + T_B
 \end{aligned}$$

$$\begin{aligned}
 (6) \quad PLMWR_{\text{active}} &= PV_{\text{MWR}} - BV_{\text{MWR}} \\
 &= PLTWR_{\text{active}} + PLT_A \\
 (7) \quad PLTWR_{\text{active}} &= PV_{\text{TWR}} - BV_{\text{TWR}} \\
 (8) \quad PLT_A &= (PV_{\text{MWR}} - BV_{\text{MWR}}) - (PV_{\text{TWR}} - BV_{\text{TWR}}) \\
 (9) \quad PLT_B &= BV_{\text{MWR}} - BV_{\text{TWR}} \\
 (10) \quad PLT &= PLT_A + PLT_B
 \end{aligned}$$

P_{MWR} = Portfolio MWR ("True" MWR)
 P_{TWR} = Portfolio TWR ("True" TWR)
 B_{MWR} = Benchmark MWR
 B_{TWR} = Benchmark TWR
 TWR_{active} = active TWR
 MWR_{active} = active MWR
 T = Timing effect
 T_A = Timing effect asset allocation
 T_B = Timing effect benchmark

PV_{MWR} = Portfolio value at the end of the period incl. effect of cash flows
 PV_{TWR} = Portfolio value at the end of the period excl. effect of cash flows
 BV_{MWR} = Benchmark value at the end of the period incl. effect cash flows
 BV_{TWR} = Benchmark value at the end of the period excl. effect of cash flows
 $PLTWR_{\text{active}}$ = Profit & loss portfolio excl. effect of cash flows
 $PLMWR_{\text{active}}$ = Profit & loss portfolio incl. effect of cash flows
 PLT = Profit & loss due to timing effect
 PLT_A = Profit & loss due to timing effect asset allocation
 PLT_B = Profit & loss due to timing effect benchmark

DECOMPOSING MWR

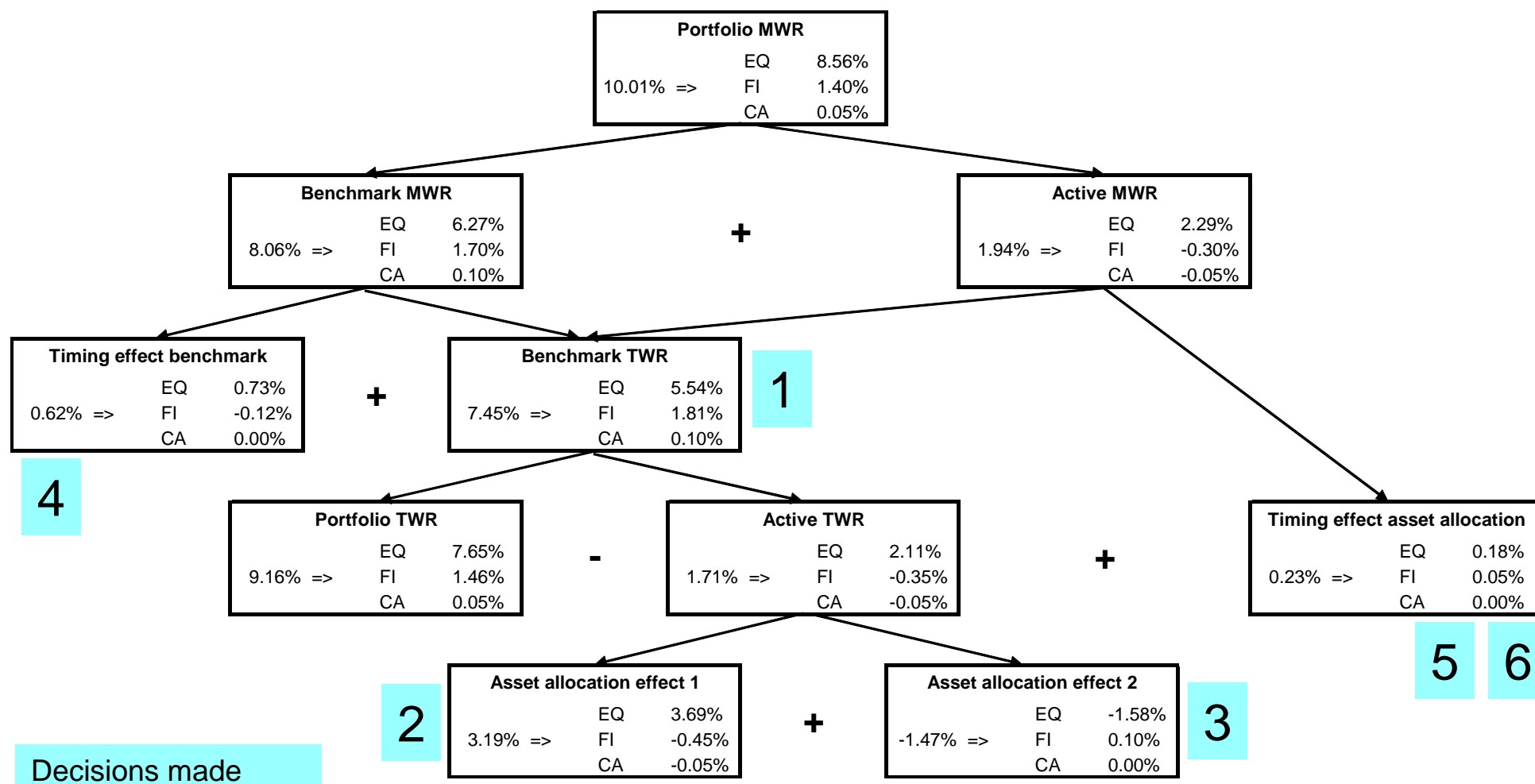
CONTRIBUTION OVERVIEW ON TOTAL LEVEL

• Decision 1:	+ 7.45%	or	+ CHF 74.47	} Portfolio manager's added value
• Decision 2:	+ 3.19%	or	+ CHF 31.87	
• Decision 3:	- 1.47%	or	- CHF 14.75	
Total TWR:	+ 9.16%	or	+ CHF 91.59	
• Decision 4:	+ 0.62%	or	+ CHF 25.93	
• Decision 5+6:	+ 0.23%	or	+ CHF 6.95	
Total MWR:	+ 10.01%	or	+ CHF 124.47	

A MORE DETAILED APPROACH - ON ASSET CLASS LEVEL

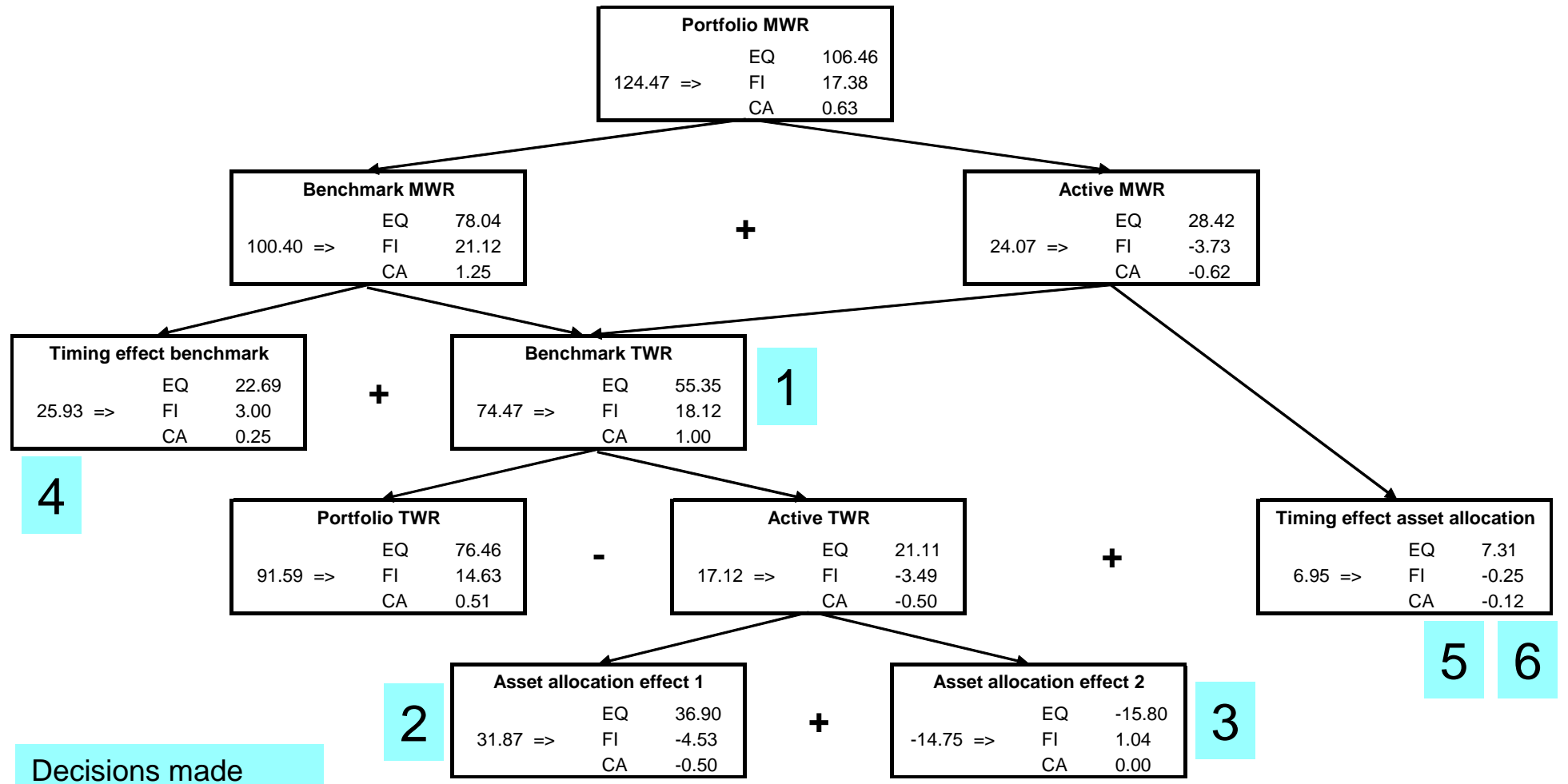
DECOMPOSING MWR

RETURN CONTRIBUTION ON ASSET CLASS LEVEL



DECOMPOSING MWR

PROFIT & LOSS CONTRIBUTION ON ASSET CLASS LEVEL



DECOMPOSING MWR

SOME FORMULAS FOR ASSET CLASS LEVEL ANALYSIS

$$(1) MWR_{Total} = \sum_{i=1}^n RC_i^M$$

$$(2) RC_i^M = \frac{AIC_i^M}{AIC_{Total}^M} * MWR_i$$

$$(3) AIC_i^M = \frac{PL_i^M}{MWR_i}$$

$$(4) AIC_{Total}^M = \frac{PL_{Total}^M}{MWR_{Total}}$$

$$(5) PL_{Total}^M = \sum_{i=1}^n PL_i^M$$

$$(6) AIC_{Total}^M \neq \sum_{i=1}^n AIC_i^M !$$

$$(7) TWR_{Total} = \sum_{i=1}^n RC_i^T$$

$$(8) RC_i^T = \frac{AIC_i^T}{AIC_{Total}^T} * TWR_i$$

$$(9) AIC_i^T = \frac{PL_i^T}{TWR_i}$$

$$(10) AIC_{Total}^T = \frac{PL_{Total}^T}{TWR_{Total}}$$

$$(11) PL_{Total}^T = \sum_{i=1}^n PL_i^T$$

$$(12) AIC_{Total}^T \neq \sum_{i=1}^n AIC_i^T !$$

$$(13) PL_{Total} = PL_{Total}^M = PL_{Total}^T$$

$$(14) AIC_{Total}^M \neq AIC_{Total}^T !$$

$$\Rightarrow (15) MWR_{Total} = \frac{AIC_{Total}^T}{AIC_{Total}^M} * TWR_{Total}$$

$$(16) PL_i = PL_i^M = PL_i^T$$

$$\Rightarrow (17) MWR_i = \frac{AIC_i^T}{AIC_i^M} * TWR_i$$

MWR_{Total} = MWR of total portfolio

MWR_i = MWR of asset class i

RC_i^M = return contribution of asset class i (based on MWR)

AIC_{Total}^M = average invested capital of total portfolio (based on MWR)

AIC_i^M = average invested capital of asset class i (based on MWR)

$PL_{Total} = PL_{Total}^M$ = profit & loss of total portfolio

$PL_i = PL_i^M$ = profit & loss of asset class i

TWR_{Total} = TWR of total portfolio

TWR_i = TWR of asset class i

RC_i^T = return contribution of asset class i (based on TWR)

AIC_{Total}^T = average invested capital of total portfolio (based on TWR)

AIC_i^T = average invested capital of asset class i (based on TWR)

$PL_{Total} = PL_{Total}^T$ = profit & loss of total portfolio

$PL_i = PL_i^T$ = profit & loss of asset class i

DECOMPOSING MWR

CONTRIBUTION OVERVIEW ON ASSET CLASS LEVEL - E.G. FOR EQUITIES

• Decision 1:	+ 5.54%	or	+ CHF 55.35	} Portfolio manager's added value
• Decision 2:	+ 3.69%	or	+ CHF 36.90	
• Decision 3:	- 1.58%	or	- CHF 15.80	
Total TWR:	+7.65%	or	+ CHF 76.46	
• Decision 4:	+ 0.73%	or	+ CHF 22.69	
• Decision 5+6:	+ 0.18%	or	+ CHF 7.31	
Total MWR:	+ 8.56%	or	+ CHF 106.46	

CONCLUSION

DECOMPOSING MWR

CONCLUSION

We need to go back to the basics
and
we need some more research on MWR
and
we need to focus more on the client's perspective
and
we need a decision-oriented return attribution
and
we need to re-introduce the MWR

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REFERENCES

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