

**PMAR Philadelphia – May 10, 2022**  
**Micro Attribution or Rules-Based**  
**Attribution (“Atoms of Attribution”)**

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The simulation assumes certain transaction costs with respect to trades made, whereas the live portfolio might incur different transaction costs.

The simulation assumes implementation of the allocation shifts by buying and selling the underlying indices, whereas live portfolios may use other instruments (i.e. futures, forwards, active or passive managers) with a different return or cost.

Hypothetical or simulated performance results have certain inherent limitations. Unlike an actual performance record, simulated results do not represent actual trading. Also, since the trades have not actually been executed, the results may have under or over compensated for the impact, if any, of certain market factors, such as lack of liquidity. Simulated trading programs in general are also subject to the fact that they are designed with the benefit of hindsight. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown.



# My Background – All Sides of the Fence

Worked at Pension Fund, Asset Manager and Hedge Fund;  
Founded: Asset Manager/Technology Firm



World Bank: Head of Quantitative Research and Analytics Group (late 1990s)  
Implemented Currency Overlay for Pension Fund (1995)



JP Morgan/FX Concepts: Head of Currency Research (1999-2007)



M<sup>cube</sup>: AlphaEngine<sup>®</sup> System for Quant Research;  
iDash iPad app for Board/CIO reporting



AEGIS: Manage Beta/FX Dynamically for Clients using Futures



Write books and papers: Asset Allocation, Attribution, Pension Reform, FX, Innovation  
Have Co-Authored Books and Papers with Prof. Franco Modigliani (Nobel Laureate);  
Prof. Robert Merton (Nobel Laureate)



# Agenda – New Approach to Attribution

Focus on Micro-Level Decisions to Attribution of Performance



Typical Portfolios Embed Many Risks/Bets



Traditional IDP Approach to Performance Attribution



May Miss the Contribution of Micro-Level Decisions



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The New Approach Tries to Complement Existing Approaches

# Consider a Typical Portfolio

Use the Investment Decision Process to Attribute Performance

## 1. Investment Decision Process (IDP)

- Captures How Decisions are Made

## 2. IDP-Based Attribution – Focus on Aggregate Decision

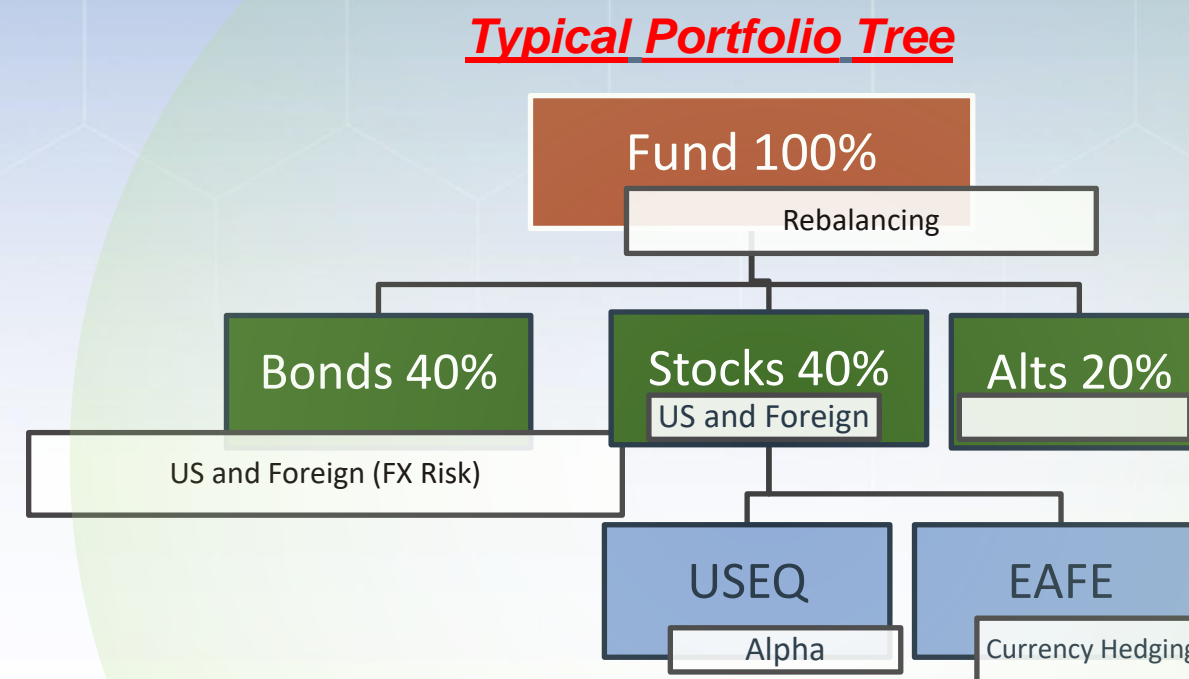
- Asset Allocation, Country Allocation, etc.

## 3. Decision-Based Attribution (Muralidhar 2016)

- Attribute Performance to Who Made Decision

## 4. Micro-Level Attribution

- Capture the Value of Rules Driving Decisions



**Attribute to**  
*Asset Allocation*  
*Within Asset Class*  
*Sector*  
*Manager Contribution*

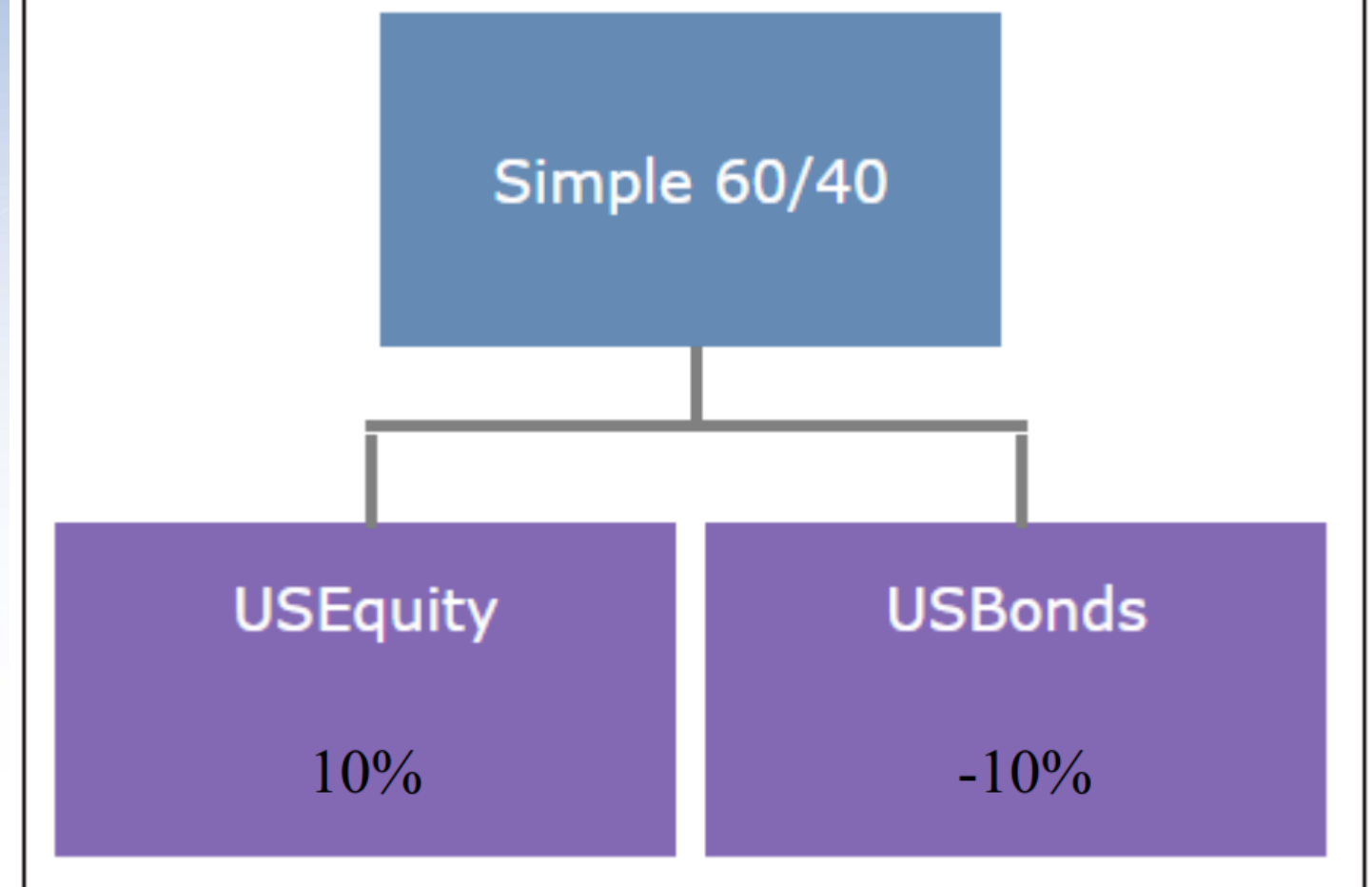


# Case Study Using a Simpler Portfolio

Investor Has to Allocate Between Two Assets

- Assume a Systematic Process
- Investor uses 2 Rules to Drive Decisions
  - Seasonality: Sell in May
  - Economic: Baltic Dry Index
- Each Rule Overweights (65%)/Underweights (55%) Equity vs Bonds
- Final Decision is Based on Aggregation of Both Rules
- Final Allocation to Equities =
  - 70% - Both Rules Overweight
  - 60% - One Rule Overweight/Other Underweight
  - 50% - Both Rules Underweight

**Figure 1: A Simple One-level Investment Decision Process**  
(source: AlphaEngine®).



# Performance Attribution: Client Case Study

## Simple Formula to Break out Contribution of Rules

Assume that there are two assets as in the example above:  $a_1 = \text{Stocks}$  and  $a_2 = \text{Bonds}$ .

The returns of each of these assets in every period =  $r(a_1)$  and  $r(a_2)$ . Further, assume that the Seasonality rule is referenced with "S." Hence the excess return (over the benchmark) of the Seasonality rule can be specified as  $r(S)$ . Also, assume that the periodic weight to each asset, relative to the benchmark, is defined as  $w(a_1)$  and  $w(a_2)$ . As a result, we can calculate

$$r(S) = w(a_1) * r(a_1) + w(a_2) * r(a_2) \quad (1)$$

If we define  $r(S_1)$  as the excess return of rule S under condition 1, then the following equation can be specified to establish the performance of each asset and the entire rule under condition 1.

$$r(S_1) = w(a_1)_{65} * r(a_1) + w(a_2)_{35} * r(a_2) \quad (2A)$$

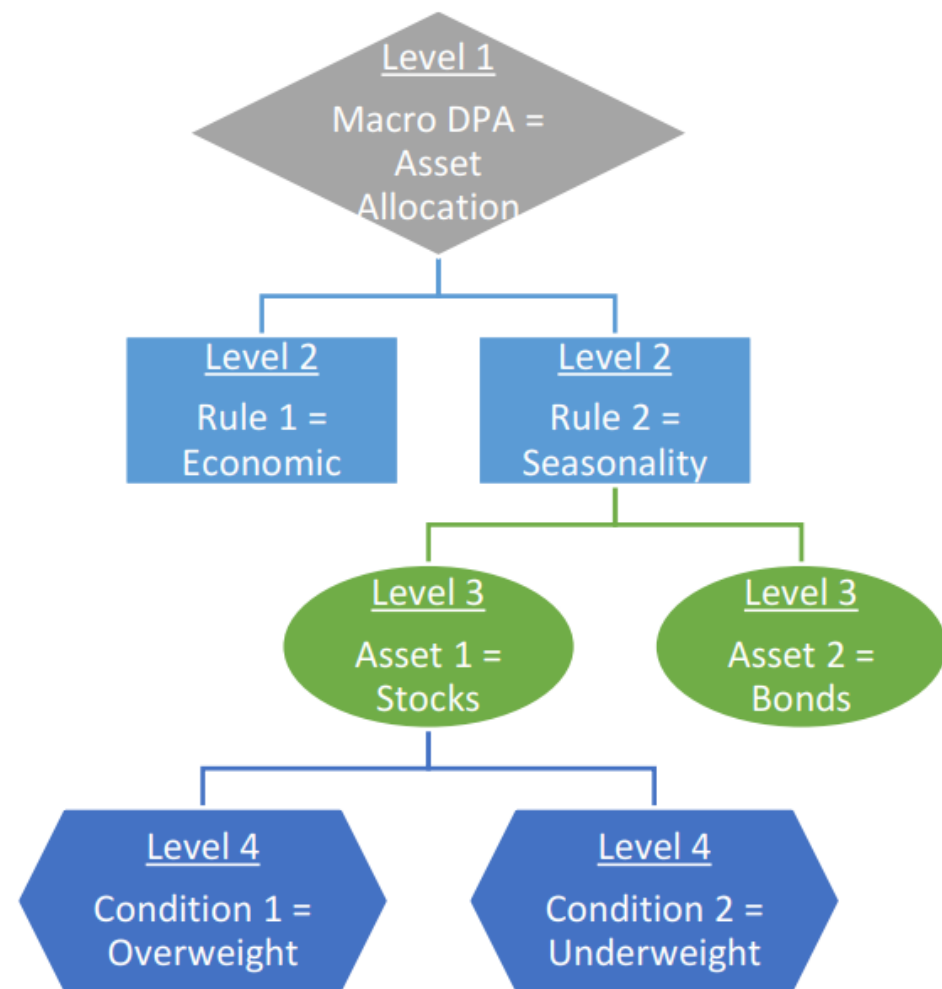
$$r(S_2) = w(a_1)_{55} * r(a_1) + w(a_2)_{45} * r(a_2) \quad (2B)$$

Moreover,  $r(S) = r(S_1) + r(S_2)$

# Digging a Bit Deeper

Which Decisions Added the Most Value

**Figure 2: The Micro-Level IDP and the Atoms of Attribution**





# Micro Based Attribution Reveals Interesting Results

While Aggregate Decisions May Add Value, Sub-Decision Can Be Improved

**Table 1: Micro DPA – Attributing Value to Individual Rules within the Macro Tactical Decision**

Decision	Annualized Added Value Total (1)	Return-Risk Ratio (2)	Average Return When Positive (3)	Average Return when Negative (4)	Success Ratio (5)	Added Value When Overweight (6)	Added Value When Underweight (7)	Percentage of Time Overweight (8)	Percentage of Time Underweight (9)
<b>1. Tactical Decision</b>	0.37%	0.31	0.03%	-0.07%	51%				
- Stocks						2.29%	-0.18%	32%	21%
- Bonds						0.34%	-1.30%	21%	32%
<b>1.1 Seasonality</b>	0.17%	0.20	0.03%	-0.04%	50%				
- Stocks			0.57%	-0.38%	58%	0.81%	-0.25%	57%	43%
- Bonds			0.25%	-0.31%	39%	0.25%	-0.51%	43%	57%
<b>1.2 Economic</b>	0.20%	0.37	0.13%	-0.12%	53%				
- Stocks			0.08%	-0.07%	56%	1.26%	0.29%	53%	47%
- Bonds			0.02%	-0.04%	51%	0.31%	-1.40%	47%	53%



**Thank You**



# Background on AEGIS and M<sup>cube</sup>

Over Fifteen Years of Award-Winning Innovations to Help Asset Owners

*Best Tactical Manager (CIO Magazine)*

*Edward D. Baker III Journal Award (Journal of Investment Consulting – 2012 and 2015 )*

*Best Pension Software (Global Pensions)*



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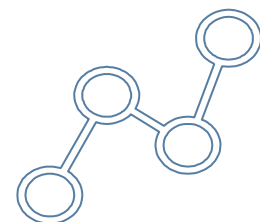


Over 20+ years experience in fund management, trading, investment research and software development



Work in Partnership with Clients to Achieve Results

\$2.1 bn in notional AUM.



Pioneer of SMART Rebalancing/ Dynamic Beta Management (2002)

