



CARF Working Paper

CARF-F-089

The Case for View Based Dynamic ALM for Japanese Pension Funds: A New Approach to Liability Driven Investing

Masakazu Arikawa
Arun Muralidhar
Sanjay Muralidhar

January 2007

✿ CARF is presently supported by Bank of Tokyo-Mitsubishi UFJ, Ltd., Dai-ichi Mutual Life Insurance Company, Meiji Yasuda Life Insurance Company, Mizuho Financial Group, Inc., Nippon Life Insurance Company, Nomura Holdings, Inc. and Sumitomo Mitsui Banking Corporation (in alphabetical order). This financial support enables us to issue CARF Working Papers.

CARF Working Papers can be downloaded without charge from:
<http://www.carf.e.u-tokyo.ac.jp/workingpaper/index.cgi>

Working Papers are a series of manuscripts in their draft form. They are not intended for circulation or distribution except as indicated by the author. For that reason Working Papers may not be reproduced or distributed without the written consent of the author.

The Case for View Based Dynamic ALM for Japanese Pension Funds: A New Approach to Liability Driven Investing

By Mr. Masakazu Arikawa, Arun Muralidhar and Sanjay Muralidhar¹

Introduction

There have been many innovations in the management of pension funds and other assets over time. However, it seems that in the recent months, two trends have taken hold of the markets. The first is a clearer recognition that assets must be tied to liabilities – a trend called “Liability Driven Investing” or LDI. The second is a separation of two different sets of contributors to returns and the management thereof – called “Separating Alpha and Beta.” We are going to demonstrate that these two trends are not separate but can be implemented effectively in one superior approach, especially if clients use SMARTs (Systematic Management of Assets using Rule-based Techniques). In short, we show that Chief Investment Officers (CIOs) can improve performance and solvency by being smart about the regular cash flow and rebalancing decisions they currently make on Beta and Alpha assets, especially if the recommendations are consolidated in a single cockpit view of the fund.

The academic work, portfolio management techniques and even risk budgeting approaches seem to have fallen behind the practical problems faced by plan sponsors as the proposed approaches are usually static. For example, recommendations such as “purchase an asset management product to match the liability cash flows” or “hire portable alpha managers and statically replicate the beta” or “rebalance your portfolio back to the benchmark weights at the end of the quarter or when some range has been reached” are all static and have severe limitations as they assume that the pension fund sponsor can then relax after making these decisions. However, these static recommendations require a single action of hiring some external manager and ignoring the amount of allocation to them in every period or implementing a rebalancing policy and ignoring it for many periods till some trigger is met (calendar period or range). These approaches are sub-optimal and one should realize that such naïve recommendations are not adequate for good governance of multi-asset, multi-manager portfolios. CIOs are constantly required to make investment decisions on rebalancing or the investment/divestment of cash flows, and we advocate that using SMARTs relative to liabilities can improve solvency without even investing in this new breed of products. We are aware of a number of plans who have adopted such an approach in the U.S. to good success in improving performance.

The Importance of Dynamic Management of Assets

A Japanese pension fund case study is used in this note to demonstrate how Dynamic Beta and Alpha Management Relative to Liabilities can help pension funds improve their overall returns and surplus position while reducing risk.² Why is dynamism so important? Dynamism in the

¹ The authors are President of M^{cube} Investment Solutions, Japan, and Chairman and CEO of M^{cube} Investment Technologies LLC (www.mcubeit.com) respectively. Mr. Arikawa was formerly President and Resident Director of Sony Global Pension Management. We also thank Profs. Takao Kobayashi, Toshiki Honda and Kazuhiko Ohashi for their kind support, encouragement and guidance. Also, thanks to the Center for Advanced Research in Finance, University of Tokyo for supporting Dr. Arun Muralidhar in this research. The views in this paper are the personal views of the authors and not M^{cube} or any previous organization that they have worked for or the University of Tokyo.

² We thank DIAM and Nomura Securities for the data and Roland van den Brink of PME in the Netherlands for his input on optimal monitoring of liabilities.

management of assets is critical because asset and manager returns are going up or down daily resulting in the weights of assets and managers changing every day. In addition, CIOs are making decisions as to what to do with contributions or which assets to liquidate to pay pensions, often in a relatively ad-hoc manner. Many pension funds feel that if they do not take an explicit decision about a manager or an asset weight, they do not have a bet on the markets. Quite the opposite is true! If a client adopts a static approach of hiring a manager with an initial allocation and letting that allocation change over time because of market movements, they are taking a lot of risk. If the manager performs well, then their weight in the portfolio increases and to not reduce the weight implies a view that the plan sponsor thinks the manager will continue to outperform. The same applies for assets (or beta) that may have drifted in allocation above the long term strategic weight because of strong recent performance. To not rebalance implies a view that this asset will continue to outperform. Similarly, triggering an automatic rebalancing decision to reduce (increase) the weight on an asset back to its benchmark weight at the end of the quarter because a particular day has been reached, implies a view that this asset will do worse (better) than other assets - otherwise to make such a decision would seem a bit contradictory. The effective management of assets would suggest that a pension fund be run like a professional asset management company, and staff should use market intelligence and SMARTs to make such implicit bets in a portfolio explicit and improve solvency.

Understanding Investment Decisions Relative to Liabilities

Previous research on the Metal Industry (PME) pension fund in the Netherlands has shown how an innovative fund can capture the performance of liabilities through a portfolio of swaps³. Estimating the “return” characteristics of the liabilities is the first step to effective LDI – without even having to invest in externally managed products. The liability return can be approximated easily intra-year by the return of a portfolio of swaps that has been optimized so that it matches the projected liability cash flow.

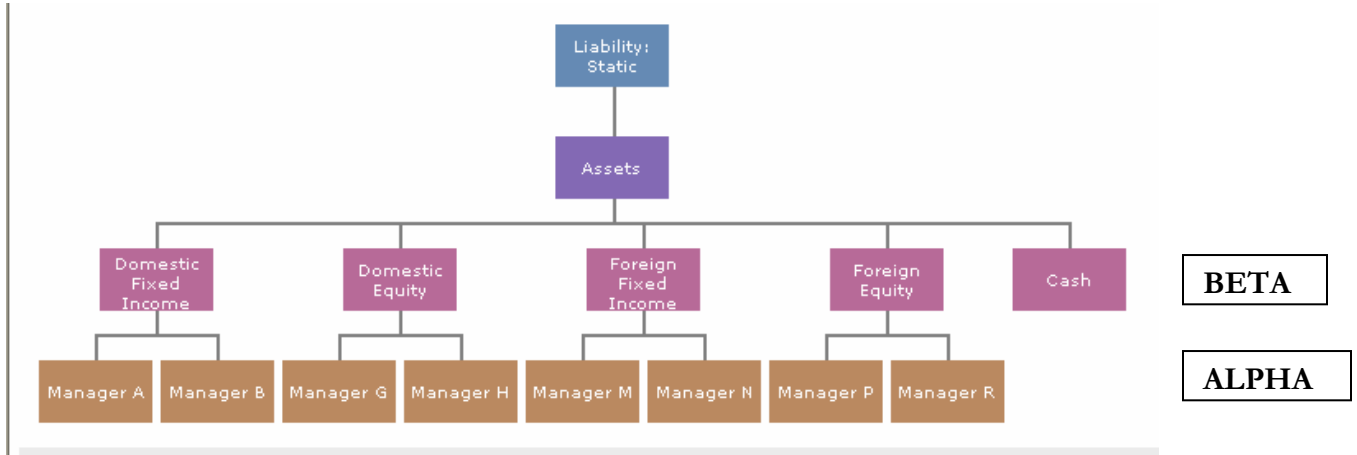
Chart 1



³ See “Swaps Form Basis of Creating a Benchmark for Liabilities” **Pensions & Investments** (05/01/06) Vol. 34, No. 9, P. 29 ; **A. Muralidhar and JW van Stuijvenberg**.

The benefit to this approach is that allows the fund to calculate the value of the liability even within a year, whereas in the past, the present value of liabilities was only calculated at year-end which sometimes was too late to effect ALM strategies. In this pension fund, the value of the liabilities is about 2 trillion yen and has a duration of approximately 20 years, and the portfolio of swaps tracks such liabilities very closely. This swaps-based technique allows us to calculate the return on liabilities modeled in Chart 1 and the annualized return of liabilities over the 2000-2005 period for this fund was 4.03% with 5% annualized volatility. Thereafter, the key statistic to measure the impact of investment decisions on solvency will be annualized growth in solvency defined as the annualized growth in assets minus the annualized growth in liabilities. The key solvency risk statistic would be the worst drawdown of the solvency statistic as this indicates the worst decline of the surplus and hence would lead to poor funding and contributions by the sponsor.

Chart 2



The goal of pension fund asset management is to perform better than liabilities and lower this risk as opposed to focusing on tracking error. Currently, investment returns are generated through a two-step investment process. The first is to set up the Strategic Asset Allocation or SAA to various indices (what is today termed as Beta assets, even though it is a bad use of the word Beta) and then hire external managers to manage assets (or what is also poorly termed – Alpha). We demonstrate the hierarchy of investment decisions in Chart 2 and assume that the SAA for the pension fund is as follows:

- 40% in Domestic Fixed Income (measured by Nomura BPI)
- 30% in Domestic Equity (measured by Topix)
- 10% in Foreign Fixed Income (measured by Citigroup World Govt Bond Index)
- 17% in Foreign Equity (measured by MSCI Kokusai)
- 3% in Cash (measured by Yutanpo Call Rate)

What is immediately clear from this picture is that many pension funds spend too much time in trying to pick the best manager or Alpha source, which may receive no more than a 5-10% allocation to the entire fund, whereas getting the “Beta” decision correct impacts 100% of the returns of the entire fund. However, by focusing on making smart allocation decisions regularly at key levels of the fund namely the correct Beta allocation (i.e., allocation to Stocks and Bonds) and allocation to external managers or Alpha, one should be able to show that the growth in solvency is improved with a reduction in the risk relative to liabilities.

Investment Options and Comparison with Liabilities

The Static Portfolio

The SAA benchmark return of this fund would have generated an annualized return of 2.75% over the 2000 – 2005 period, with an aggregate outperformance of 0.29% from static allocations to all managers (static Alpha) for a total annualized return of 3.04%.

While most pension funds should be happy that they beat their SAA by 0.29% p.a., when we compare the return of the asset portfolio to the Liabilities, we see that the Liability return was 4.03%

annualized leading to a negative growth in solvency of approximately -0.99% per year. The details are provided in Table 2 below. Therefore, a naïve investor that made only static manager hiring decisions may have beaten the SAA, but severely underperformed the Liability return and hurt their pension fund. More important, the worst drawdown of the growth in solvency would have been -32.39%. In other words, based on the history of assets and liabilities, the worst decline of the actual surplus was 32.39% - an event experienced (possibly to a lesser extent) by many funds even in the U.S. when stocks and interest rates declined. Basically, the traditional approach of a fixed SAA (and fixed manager allocations) would have made sure that this fund's solvency declined dramatically because the SAA has a negative correlation of -0.13 vs the liabilities. Table 2 will compare various portfolio structuring options along these key parameters.

Introducing Dynamism into the Portfolio

With a clear understanding of the entire portfolio structure and how decisions are linked in a fund (Chart 2), we explore some dynamic elements. We will then show that the fact that pension fund CIOs are already making decisions on cash flows and rebalancing provides ample opportunity to improve performance and solvency.

- 1) Drift: The simplest dynamic decision is to let a portfolio drift based on market movements with no interference from staff. In other words, the allocation of any asset or manager going forward will be determined by the relative returns and the initial weight in the portfolio. Many authors and academics have written about why such a process is bad for portfolio management so let us examine the results. One can think of examining the drift of a portfolio as nothing more than a rebalancing policy with no limits or triggers. Therefore, we have created a Rebalancing Policy with all the key assets at their strategic weights and set the ranges to trigger a rebalancing at 100% (effectively, never triggered). We find that it would have cost the fund -0.18% excess returns annualized with 1.7% tracking error and the drawdowns would have been enormous. This is not an interesting case but we highlight it as Rebalancing is a form of Drift – a point not clearly understood by the many people who advocate naïve Rebalancing policies.
- 2) Automatic or Static Rebalancing: Since letting a portfolio's allocations to various assets be determined by market movements is poor governance, one would probably get fired for doing this. Many academics and consultants (including some famous endowment CIOs) strongly recommend that a portfolio be rebalanced by imposing some bands around the strategic portfolio weights. We call it Static Rebalancing in that the limits are set once, but the portfolio is still drifting within the bands. Most policies we have examined are silent about what actions staff should take within the bands. Implementing a time-based rebalancing (where assets are rebalanced every month or quarter) is no different. We have assumed that the ranges around equity assets are 5% and around fixed income and cash are 3% to reflect the differences in volatility of these assets. Evaluating this strategy over the same period shows that Static Rebalancing would have added 0.16% relative to the SAA so this is an improvement over Drift.

The problem with Static Rebalancing policies is that while they have low tracking error to their benchmarks, they can have large absolute and relative drawdowns. Therefore, when the asset markets declined dramatically from 2000 to early 2003 around the world, Rebalancing would have done nothing to reduce the pain of the pension fund and would have caused the rebalanced portfolio to plummet as well. The more important question is what would have happened if we had included such a policy relative to the liability? Looking at a much more detailed report of the

performance of this Rebalancing against Liabilities (highlighted in Table 2), we see that this approach added value but was not enough to make assets grow faster than liabilities. The correlation between assets and liabilities is a little bit lower at -0.129, but the drawdown is still worse than -30%. *In short, Rebalancing is better than Drift, but it is just a reduced form of drift and has no intelligence in it to improve the solvency and risks of the fund.* Therefore, clients cannot naively manage Beta assets using static rebalancing policies for a dynamic market.

Beta Management: We will focus on two types of beta management – Simple and Intelligent Beta Management. First, we ask the question: What is Beta Management? Beta management requires a responsible investor to determine what factors affect whether the assets in their portfolio will perform well or poorly based on current market factors and make appropriate decisions on beta assets to reflect such analysis.⁴ All the analysis to make such intelligent decisions are publicly available and have been researched by the many banks and academics. Being SMART with respect to Beta is about creating simple rules that can capture the available market research, but more important have relevance to the Liabilities of this fund. The regular output of such rules is the recommended asset allocation weights to Beta assets depending on whether assets are favored or not in the current environment. Hence beta management is about Dynamic Asset Allocation (DAA) and not static allocation. Dr. Woody Brock would term Beta Management as Dynamic Passive Management.

First we show some examples of Beta Management strategies and then the difference between Simple and Intelligent Beta. We start with examples of a SMART approach using factors that can help manage allocations between Japanese Stocks and Bonds. For example, two profitable rules could be specified as follows: favor Stocks by 1% over the benchmark weight of 30% when dividend yields are high or 2-month moving average of the Topix is greater than a 6-month moving average of the Topix or underweight by 1% when the opposite is true. Clients can evaluate many such ideas and ensure that their consistent application can lead to positive outperformance. Applying the consistent discipline of tilting stocks versus bonds by just 1% at the margin would have generated an additional value of 0.11% annualized for 0.26% tracking error for the Dividend Yield factor (Rule 2) and 0.25% annualized for 0.33% tracking error for the Momentum factor over the historical period (Rule 4). The details are provided in Table 1. However, the value of such ideas is not that they outperform a benchmark over the long term, but there is good discipline in the consistent application of these ideas leading to strong performance over the entire period with 3 strong positive calendar years, one negative and two flat. An investor interested in good governance, would build multiple such rules on many factors including the Japanese Yield Curve (favor stocks when curve is flat), Japanese yen (favor stocks when Yen is weak) etc. Now, when a cash flow decision needs to be made, the client will have a simple report that captures the recommended allocation to be overweight or underweight based on these various factors and can now use intelligence to make the best decision.

To get really SMART, we combine 9 such Rules, equally weighted, into a Strategy called the Simple Beta Strategy. The reason we call this the Simple Beta Strategy is that all Rules are evaluated purely based on their performance against the SAA, and ignoring Liabilities. What we can show is the combined impact of the entire set of Rules would be 1.56% annualized for just 1.19% tracking error and an information ratio of 1.3 as shown on the top line in Table 1. This is

⁴ This is quite different from tactical asset allocation (TAA) which is often unconstrained, though the same discipline of a good TAA program can be applied to just the beta assets and constraints.

a fascinating result as the Annualized Return-Risk ratio (Information Ratio) of all the individual Rules are below 1, but an equally weighted mix provides diversification of factors and therefore an Information Ratio of 1.3. However, one important item to note is that the excess returns of some Rules (Rules 1, 3, 6 and 7) are negatively correlated with the SAA, and the Strategy is positively correlated (last column in Table 1). This correlation information will be leveraged in establishing the optimal program versus liabilities.

Table 1 – Nine Diversified Rules Equals an Efficient Strategy

	Allocation Among Assets	Key Factor for SMART	Annualized Excess Return (%)	Annualized Tracking Error (%)	Annualized Return-Risk Ratio	Correlation with SAA
Strategy	All Beta Assets in SAA	Simple Beta Strategy	1.56%	1.19%	1.31	10.6%
Rule 1	Japanese and International Equity	Yield Curve Comparison	0.20%	0.37%	0.5433	-1.7%
Rule 2	Japanese Equity and Bonds	Dividend Yield Seasonality of Markets	0.11%	0.27%	0.4248	32.4%
Rule 3			0.05%	0.33%	0.1594	-2.7%
Rule 4	Japanese Equity and Bonds	Momentum of Stocks	0.26%	0.33%	0.7717	15.9%
Rule 5			0.15%	0.16%	0.95	21.8%
Rule 6	Japanese Equity and Bonds	Japanese Yen Strength	0.24%	0.33%	0.7087	-21.3%
Rule 7			0.15%	0.17%	0.8793	-6.0%
Rule 8	Japanese Equity and Bonds	Bonds vs Stock Performance	0.32%	0.33%	0.9766	22.5%
Rule 9	Japanese and International Bonds	JPFI v INFI Yld Mom	0.04%	0.18%	0.2452	36.9%

This Dynamic Simple Beta Strategy when added to the fund causes the Portfolio to outperform liabilities by 0.69% annualized. Therefore, solvency is immediately improved by moving from Rebalancing to Simple Beta Management.

While the Simple Beta Strategy improved the returns of the assets versus the liabilities, it has had a small impact on the Surplus Drawdown reducing it to -28% (Table 2), but the dynamic portfolio still has a -0.12 correlation with the liabilities – in short, not much of an improvement on the solvency risk profile.

Intelligent Beta Management selects only the 4 Rules (Rules 1, 3, 6 and 7) that had a negative correlation between the excess returns and the SAA. We do not show that this approach would have had a lower Information Ratio of only 0.88 (compared to the Simple Beta strategy), but when we include this strategy in the fund, the annualized growth in the solvency is the same under Simple Beta (0.73% annualized), but more important the drawdown is reduced to -25% and the correlation is improved versus the liabilities to -.08. We have not optimized the rules and their weights, but

clearly just implementing naïve beta strategies or pure TAA strategies is very different from running an Intelligent Beta Strategy relative to liabilities.

Table 2- Comparing the Different Beta Strategies

	Annualized Return (%)	Annualized Std Deviation (%)	Annualized Return-Risk Ratio	Max. Drawdown Excess (%)	Correlation with Liability
Liability	4.03%	5.14%	0.79	NA	NA
Static Beta	3.04%	6.31%	0.48	-32.39%	-0.1379
Rebalancing	3.26%	6.17%	0.53	-31.47%	-0.1296
Simple Beta	4.72%	6.52%	0.72	-28.34%	-0.1262
Intelligent Beta	4.76%	6.33%	0.75	-25.12%	-0.0826
Intelligent Alpha & Beta	4.79%	6.33%	0.76	-25.2	-0.0821

- 3) Dynamic Alpha Management: We will not examine Dynamic Alpha Management with the same detail, but the concept is very simple and there is an excellent reference on this topic.⁵ What the authors pointed out, and this is highlighted in our book⁶, is that most investors have only focused on which manager to select and ignored the very important decision of how much to allocate to them on an ongoing basis, especially given that CIOs are making decisions on cash flows. If we have hired many managers because we did not want them to be highly correlated, then there will be period when some managers do well and others when they do badly. A smart investor will investigate such relationships at the time of hiring external managers and will use SMARTs to track their managers. Now when there are cash inflows into the fund or pension payments to be made, a SMART investor can intelligently decide which manager to allocate to or take these assets from. In the example in Table 2 we applied some Rules just to Foreign Equity managers, but the smart investor should recognize that we could have applied the same technique for all asset classes where external managers have been hired, thereby increasing the scope of the value-added and management of solvency risk.

Summary

Little attention has been paid in the past as to how CIOs should rebalance or make decisions on cash flows. We have shown that by using SMARTs CIOs not only improve the performance of the asset portfolio, but also to help generate adequate value relative to the liabilities and improve the solvency risk profile. The choice of which factors to use for Intelligent Alpha and Beta Management and what weight to give them is very dependent on each pension plan and this is where one has to be very careful about generic recommendations about what to do with your pension fund.

Based on all the Rules developed for this fund, the CIOs can get a simple report every day/week/month as to how the assets must be rebalanced or cash flows invested using SMARTs. Now there is a lot of transparency in how the fund is managed as processes are formal and disciplined and decisions integrated in a single cockpit view. More important, controls and risk management can be implemented before decisions are made as opposed to catching these later on

⁵ "Investing in Mutual Funds when Returns are Predictable," D. Avramov and R. Wermer, University of Maryland Working Papers, 2005.

⁶ Innovations in Pension Fund Management, Stanford University Press, 2001.

from custodian reports.⁷ This is a very critical point and very important for good governance of the pension fund.

There has been a lot of discussion in the press about LDI and Alpha and Beta management, but we have shown here is that the previous discussions were static and focused on hiring external managers whereas a truly innovative way to run a pension fund is to leverage rebalancing and cash flow decisions by Dynamic Intelligent Beta and Alpha Management Relative to the Liabilities. This is not difficult to do if one has the right vision and is willing to make the necessary effort to apply to their fund. In this way, pension fund can not only model and monitor their pension funds and external managers, but also measure and monitor the risks they are taking and develop appropriate strategies to manage them. In short, pension fund CIOs can use SMARTs to outperform their liabilities and simultaneously lower solvency risk by improving the quality of the decisions currently made by them.

⁷ We thank Mr. Roland van den Brink, Director of Investments, Bedrijfstakpensioenfondsen Metalektro, The Netherlands, for this very strategic and valuable comment about good governance before decisions are made.

THE DIFFERENCE BETWEEN SAA, DAA AND TAA

This note provides a brief description of the differences between Strategic Asset Allocation (SAA), Dynamic Asset Allocation (DAA) and Tactical Asset Allocation. All three are very important concepts in the management of assets and as we will show in this note, while a lot of attention has been given to SAA and TAA, not enough has been given to DAA, which may be the most important aspect of pension fund management. The core message of this note is that because asset markets are going up and down everyday, and because pension funds are making a lot of investment decisions either by investing cash flows or liquidating assets (or even by doing nothing), the actual allocation of the fund is changing daily and causes pension funds to take unintended risks (or what we call implicit bets). Such changes in allocation and implicit bets affects performance and risks. Therefore, good pension fund management requires CIOs to have a clear idea of how they make such decisions as opposed to letting market movements determine allocations and this is the role of DAA.

SAA: The strategic asset allocation is the best long-term annual asset allocation to meet the pension liabilities. It is typically designed for a 5 year horizon and focuses on the major asset classes (e.g., Domestic Stocks, International Stocks, Domestic Bonds, International Bonds, Alternatives and Cash). However, since it is impossible to keep the weight of the actual allocations at the SAA level at all times – because markets are moving every day – most consultants/advisors suggest that pension funds establish ranges around the SAA within which the SAA is allowed to fluctuate. In choosing the SAA, typically assets are chosen that are not highly correlated to ensure diversification of performance. However, a low to negative correlation (say between Domestic Stocks and Bonds) means that when one asset has positive performance, the other is likely not performing as well. Therefore, a smart investor who has selected assets with low to negative correlation, will be wise to not constantly stick to the fixed weights of the SAA (as that implies a bet and will be costlessly) as portfolio tilts within the range can benefit performance and risk. Most SAA models do not capture such dynamics and ignore pension management issues (such as the need to invest cash inflows and disinvest outflows) as they only look at performance and risk from an annual perspective.

DAA: Dynamic asset allocation follows immediately after a pension fund adopts an SAA and sets the ranges. Since assets that are poorly or negatively correlated could be moving in different directions, an intelligent analysis of what is the best position within the range can greatly enhance performance as opposed to letting the market drift make such decisions for the clients. DAA is a way to get a better understanding of why assets are not highly correlated and to understand which economic factors are positive and negative for assets. For example, a strong yen could be bad for Japanese export stocks, but may make Domestic Bonds attractive to foreign investors (and hence returns will be negatively correlated). DAA is formalizing these economic factors into simple rules that allow the pension manager to stay within the SAA ranges, but only bring allocations to benchmark for assets that are overweight, if market factors are negative. Similarly, it would only bring allocations back to benchmark for assets that are underweight, if market factors are positive. To do anything but this sort of DAA is taking the wrong bet against market

factors and will lead to losses in performance. Therefore, DAA provides the discipline and process to manage the investment decisions within annual periods and within ranges as such policies are not stated in the SAA. The best DAA policy for each client is unique and will depend on the assets in the SAA (and potentially liabilities), the ranges and the definition of factors and risks by each client. Also, many DAA programs may operate solely on pension cash flows and hence may require decisions no more frequently than once a month.

TAA: Tactical asset allocation is a program of trading that uses a similar concept to DAA – namely, of understanding what factors impact various assets positively and negatively to make investment decisions – but is very different from DAA. First, TAA can be applied to assets that are not in the SAA (e.g. Commodities are typically part of any good TAA program, but also TAA managers like to make allocation decisions within asset classes to increase diversification). Second, typically TAA programs do not have any ranges for the trading of assets and are typically driven off volatility targets. Third, TAA programs are of the nature of “one size fits all clients” and hence little customization for individual client’s long term objectives. Fourth, TAA programs are not implemented with pension cash flows but typically using only derivatives. Fifth, while DAA programs are the responsibility of pension staff, TAA programs are offered by external managers. Sixth, TAA is about potentially managing positions daily to minimize short term drawdowns. Finally, TAA programs are about trying to produce the highest information ratio, whereas in DAA sometimes the most effective DAA program may not use all possible market factors (as some factors may have nothing to do with liabilities and hence cannot improve pension solvency) and may have a goal of increasing the correlation of assets to liabilities and therefore may not have the highest information ratio.