

ALM ISSUES IN THE MANAGEMENT OF PENSION FUNDS: INTERNATIONAL EXPERIENCE AND RELEVANCE FOR INDIA

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In the last one decade in general and three years in particular management of the pension funds posed significant challenges to the administrators. On the one hand we have witnessed the shift from defined benefit schemes to defined contribution schemes. Within defined contribution schemes, administrators find it convenient and safe to move towards unitized funds from non-unitized one. The issue does not stop here whether it is unitized or non-unitized pension funds, as ALM issues dominate the agenda in light of declining interest rates world over.

While the pension funds have to maintain the security and confidence, it is equally important to observe transparent procedure so as to enhance confidence in customers/contributors' mind. This paper attempts to list out issues faced by the pension funds in the field of the ALM, drawing from the experience of various select countries. Section I of the paper deals with various risks facing the pension funds, especially those risk which affect security, confidence, transparency etc. In Section II, we discuss how these risks could be shared between various participants including the use of an econometric model. In Section III, we briefly explain the importance of ALM in the pension funds and the last section deals with the issues to be addressed with reference to unitized pension funds and a brief comparison of various models used.

Section I

Identification of various risks : The following risks are very important in the field of pension funds management with a special reference of ALM. To understand these risks, let us consider the experience of Japan in the last one decade. We all aware that Japan is the 2nd largest life insurance market in the world, but it is also interesting to note that in the last 3 or 4 years, 8 Japanese insurance companies have either become insolvent or enter rehabilitation programme. More than 10 million policies, which have been previously guaranteed, have to be cancelled. In the case of 5 companies the pension holders accepted lower benefits, commensurating with the prevailing low interest rates; 3 companies levied additional surrender penalties. All these developments have resulted in the erosion of confidence in pension business, which resulted in the marked increase in the surrender rates and significant decline of almost stagnant business volume earlier. To explain the situation further, we considered the guaranteed interest rate in the Japanese market during 1952 to 2001. (Table-1)

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Table 1 : Interest rate guarantees in the Japanese market

Policy issue year	Policy duration			Fund yield
	< 10 years	10 < . < 20 years	20 years < .	
Up to 1952	3,0%			Actual fund yields in this period usually in excess of guarantees
1952 – 1974	4,0%			
1974 – 1976	4,5%			
1976 – 1981	5,5%	5,5%	5,0%	
1981 – 1985	6,0%	5,5%	5,0%	
1985 – 1990	6,3%	6,0%	5,5%	
1990 – 1993	5,8%	5,5%	5,5%	Actual fund yields in this period often below guarantees
1993 – 1994	4,8%			
1994 – 1996	3,8%			
1996 – 1999	2,8%			
1999 – 2001	2,0%			
2001 to date	1,5%			

Source : Watson Wyatt

The consequence is a huge negative spread for life insurance industry in Japan. NLI research Institute reports that 10 companies amongst the biggest ones (representing together 127 Y billion reserves) revealed an average interest rate of 3,64% where ten years government bond yields in Japan were around 1% during the last 3 years.

The experience of Japanese and a few European countries clearly revealed the following risks:

1. Financial Bankruptcy: This is a risk of solvency as assets are far below that of liabilities. Even in the projected future period, the projection will clearly indicate assets being consisting and significantly lower than liabilities. (e.g.) Nissan Mutual affair. Possible solution to address this risk could be to avoid the risk of reducing the minimum guaranteed rate or of increasing the surrender penalty?
2. Fraudulent Bankruptcy: This is a kind of operational risk, which results from bad management and lack of internal controls. This is also the risk resulting from not maintaining the arms length relationship between the administrators of pension fund and employer. (e.g.) Maxwell syndrome. Is it sure to let my employer manage as the same time my wages and future pensions?
3. Inflation risk : This is a kind of economic risk where the purchasing power of pension is completely eroded due to high inflation. It is what happened in France between World War I and World War II.

4. Short term market risk : This risk emanates from low interest rate scenarios which reduced the income from assets and also threaten the balance sheet values. (e.g.) 2002 Europe situation, where financial investments lost more than 30% of their value in less than 1 year. What happen to people retiring during this specific period?
5. Long term market risk: After 1929 financial crisis markets have needed more than 25 years to recover their previous level.
6. Longevity risks: Risk due to improvement in life expectancy. In continental Europe, the life expectancy at birth date is improving by 1 quarter per year since beginning of the century. In India comparing the last two mortality tables and recent experience, one can reasonably expect that mortality improves by about 1% per annum in the last 10 years.
7. Wage evolution risks: some defined benefits schemes include promises they can no longer be afforded. The risk is often based on wage evolution, or even in the case of Pay as You Go scheme.

All these risks are real and pose considerable threat to pensioners confidence. Hence attempt must be made to identify, control and mitigate them. Transfer of risk is an important segment in the Actuarial Control Cycle. These mitigations techniques are suggesting ways to share them between State, insured and insurance company in a very transparent way also.

OECD, taking lessons from experience in OECD countries which are representing \$ 9000 billions reserves, meaning 30% of OECD financial assets in 2000 (source OECD secretariat) published guidelines for pension funds governance² in July 2002. They wanted to protect retirement benefits from mismanagement and fraud. This guidelines include rules for governance structure and governance mechanisms like :

- Appropriate legal and governance structures to ensure funds are managed in the interest of plan members;
- Accountability, integrity and professionalism of individuals on fund's governing body;
- Transparency and rules for communication between fund managers and plan members;
- Actuarial certification, independent auditing and the role of both actuaries and auditors as "whistleblowers..

This is very important to note that OECD included in their report that pension fund governance body responsibilities include at least ensuring diversified asset allocation.

² See "Guidelines for Pension Fund Governance.", OECD secretariat, July 2002.

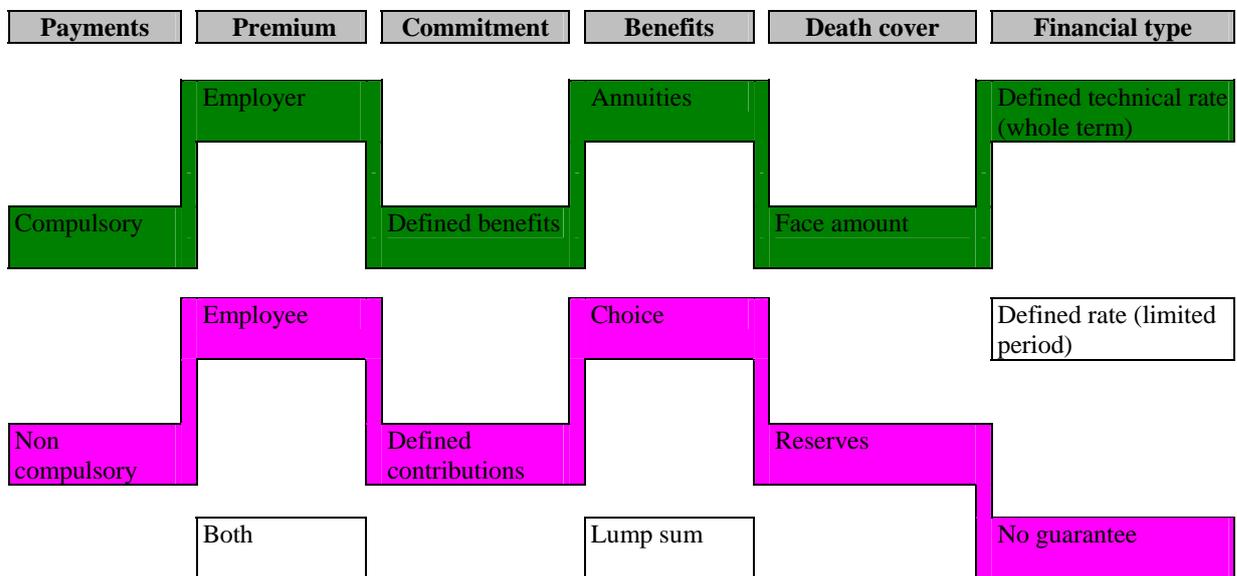
Section II

Different ways to share the risks between insured and pension funds

There are many ways to structure the risk and profit sharing between State, pension funds and insured people. It depends on the organization on the liability side, on the assets side, the capital, and the management.

Let's imagine two very different schemes, both of part of pensions funds. These are totally different approaches.

Table 2 : Products design



Product 1 (Green) : defined benefits scheme (% salary before retirement), technical rate 2%, mortality table fixed and technical rate fixed for whole life.

Product 2 (Pink) : defined contribution scheme, unit linked, without commitment on mortality table, death cover during accumulation period equal to mathematical reserves.

Table 3 : comparison of the two pension funds according to three main risk factors

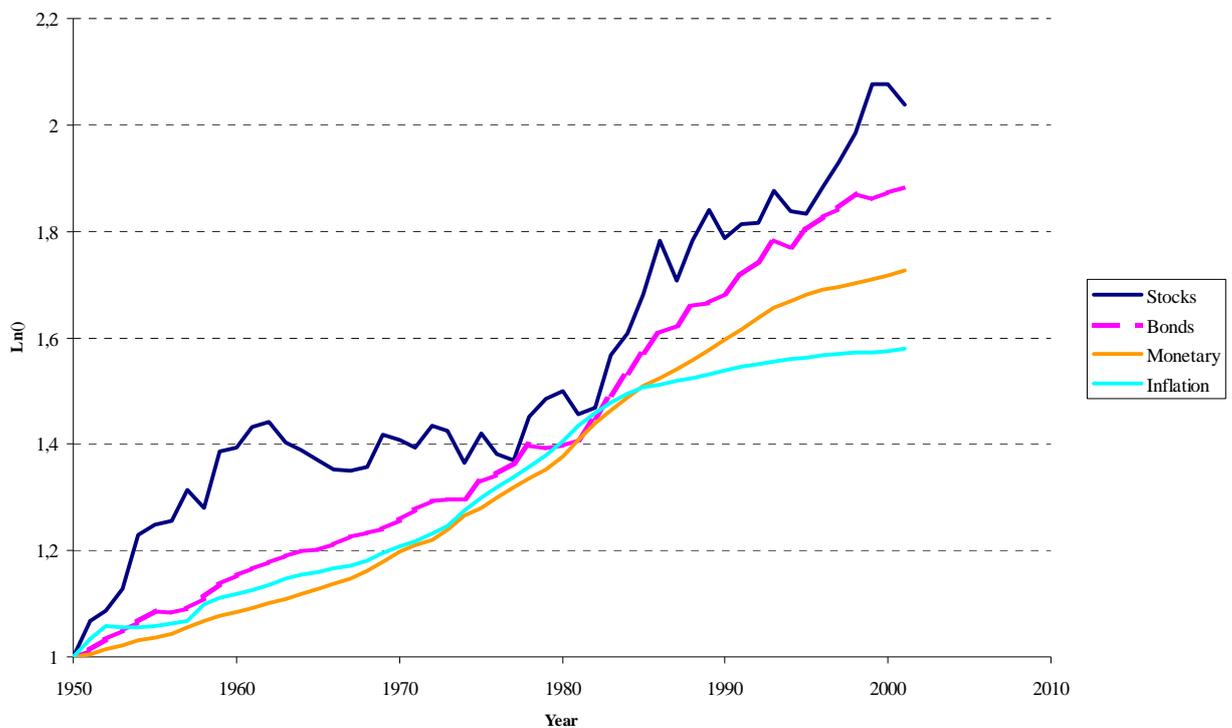
	Product 1		Product 2	
	Insured	Pension funds	Insured	Pension funds
Longevity risk	0	+++	++	+
Inflation	0	++	++	0
Market risks	0	+++	+++	0

Product 1 : let's secure the funds

For this kind of high promise product, having a low technical rate is necessary but not sufficient to boost the confidence and security. We need at the same time a good understanding on ALM. There are some models used by European actuaries based on micro-simulation to determine strategic allocation. The process has 3 steps : determining assets historical on long period, simulation of many scenarios (at least 5000), trying many combinations which will help you to select the best one.

Example of French evolution of assets

Graph 1 : evolution of French assets during the last half a century



Source Cardif Assets Management

This graph shows that of course stocks have over-performed other assets. If you entered the scheme in 1965 to receive your first annuity in 1982 the best asset wouldn't have been stocks but bonds. What is important is to consider simply the term of investment. Since 1950 in France, considering the 47 periods of 5 years, stocks had the best performance only in 21 times ... On the other hand, inflation have been subdued over any kinds of assets during the entire period..

Table 4 : best asset by period duration

Period (between 1950 and 2001)	Stock	Bonds	Monetary	Inflation
5 years (47 periods)	21	11	9	6
10 years (42 periods)	20	8	8	6
15 years (37 periods)	16	10	11	0
20 years (32 periods)	11	12	9	0

This table clearly emphasizes the importance of diversification, which is crucial for ALM.

Take care about people expectations

Most of the members are non-technical and hence they cannot appreciate this kind of pure performance index and assets volatility. They are more concerned with risk concept like: probability of the fund to be under funded at least once in the next 20 years or probability to be under 105% over funded at least two times in the next 30 years. They are more concerned by performance concept like for example evolution of future annuities compared to inflation. Also in the ALM program we have to identify this kind of expectations better than pure mathematical parameters.

An understandable ALM model

One example of simple methodology is to micro-simulate evolution of assets using auto-regressive model. The model could be as simple as the following. Let's take a vector X with p types of financial and economical parameters (bonds, stock, inflation, wages, gold,...). Theory shows that the more types of financial and economical parameters you include, the more precise and stable will be the simulation:

$$X_t = \mu_x + \Omega_x (X_{t-1} - \mu_x) + \varepsilon_t$$

(p,1) (p,1) (p,p) (p,1) (p,1) (p,1)

with $X \approx L(\mu_x, \Sigma_x)$, μ_x vector of historical evolutions, Σ_x variance/covariance matrices, $E_t \approx N(0, \sigma^2 I_p)$ noise vector, $\varepsilon_{j,t}$ with $j = 1 \text{ à } p$.

The main difficulty is the estimation of Ω because it's highly depending on the period of estimation (see graph 1 for France) and of μ which represents the relative trends of each class of assets.

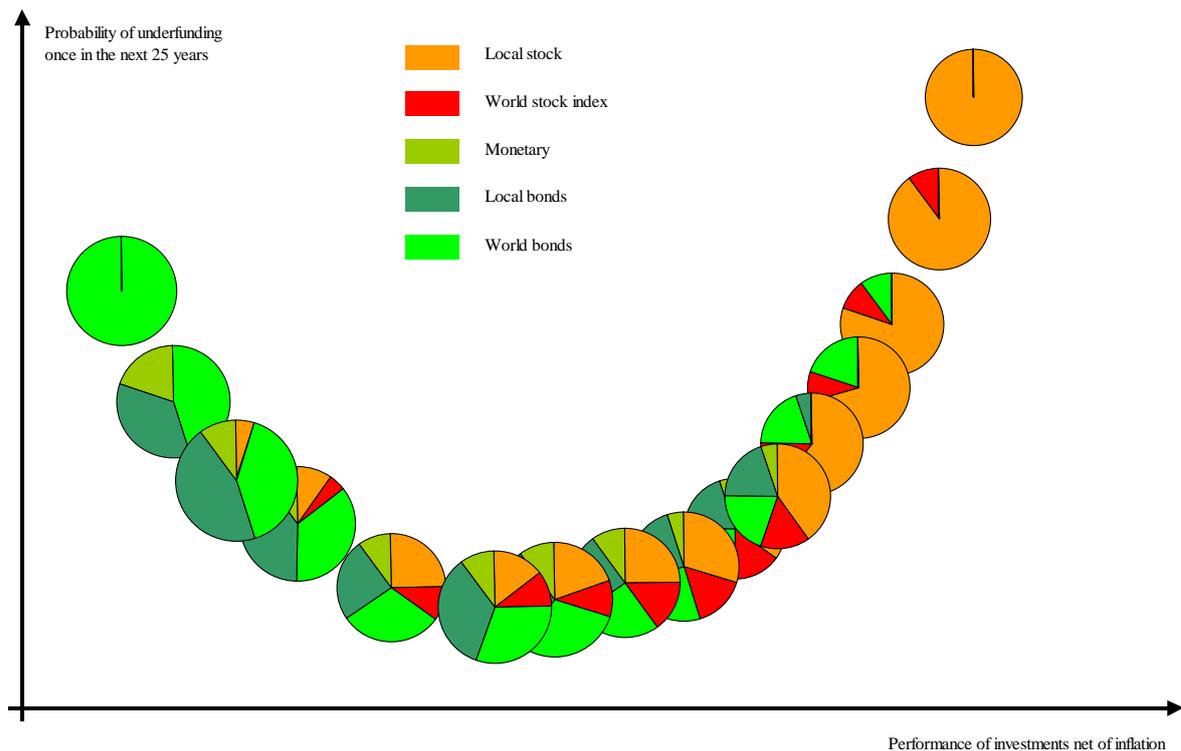
It could give you results like the following one. Each graph is a portfolio composed of different assets in different proportion. We've simulated this portfolio for a pension fund similar to product 1 for the next 30 years (5000 drawings). On the liability side we simulated the pension fund : new contributions, mortality, wage increase and so on.

We kept in graph 2 only the external portfolios of the set. In the initial simulation more than 500 have been present. The portfolios on the right side of the border are the best ones according to the defined specific criteria. Of course, changing of risk criteria or of

performance criteria would change the classification of the portfolio. This example of concrete and adapted efficient frontier gives very simple conclusion:

- diversification is the key factor regarding the security of the funds
- diversification in term of assets and period is important
- over a long period, bonds only are not safe as their value is eroded by high inflation.

Graph 2 : example of concrete ALM



Security and confidence.

In case of a product with a high promise insurers have to secure the scheme and keep insured's confidence in taking low technical rates.

Product 2 : let's share the risk.

Unit linked product for accumulation period and annuities

In Europe, France is distributing unit linked life insurance products for more than twenty years (accumulation period) even if unit linked annuities are new in the market. According to this experience, key points are the following :

- Clarifying the transfer of risks through very clear explanation: the pension funds guaranties only a number of units, the value of each unit can decrease.

- Smoothing the individual portfolio to avoid large sales during high markets (single premium) and a forced sale at the age or retirement. The processes of investment have to be continuous and hence encourages active trading on a long period.
- Adapting the portfolio to the remaining duration of the plan (age).

Insurance Authority is asking insurance companies to be very precise on who is taking risks and what kind of risk it is. The communication to policyholders is strictly regulated. This is a way to guarantee the transparency.

Adapting portfolio to age

Pension funds have to consider at the same time the duration of each individual plan and the profile of benefit and future premium. For example, consider a man aged 50 and a woman aged 35 . We cannot propose the same assets allocation to the following 35 years old woman who wants only annuities as compared with 50 years old man who wants 30% lump sum at the date of retirement and 70% annuities.

Graph 3 : Mathematical reserves



Section III

Why ALM is such a key point in pension sector ?

In the life insurance industry, Asset Liability Management has assumed a crucial importance in recent years. But the importance is more pronounced for pension funds, which emanates from different factors specific to pension funds, as explained below.

Firstly, the revenue of pension fund is no more a small portion for the household but it is a necessary component of the budget, because people after retirement need regular money to be able to buy health protection. In some western countries you see the boom of travel industry supported by young retired people even in period of crisis. Pension funds annuities have also to be strongly protected against high inflation rates.

Secondly, ALM is a key point for pension funds because of duration. To be efficient, the members of a fund must enter the plan young enough (before 45 for example). The average duration will be far longer than duration of traditional life insurance schemes. Considering the heterogeneity in term of volatility and trend of different types of assets during the previous century optimization of the allocation is one of the pillars of pension industry.

Thirdly, pension funds have to manage very different profiles. Long duration, uncertainty of life expectancy, heterogeneity of contribution between members, in certain cases differences of behavior at the age of retirement (100% life annuities against 70% annuities/30% lump sum), sometimes possible reversion to the widow could be various elements to take into account in the optimization. Mathematical reserves, contributions and benefits aren't as predictable like with simple endowment or money bank products. ALM has also to be a very serious matter to secure the scheme whatever the profile of the accumulation period and benefit period.

Section IV

Issues to be addressed in the case of unitised pension funds (defined contribution) :

ALM is finally far more important in case of unitized pension funds: because in these schemes you transfer the risks to the members. Because they don't have the capital of pension fund and because they are less financially educated than Insurance Company you have to propose them a tailor made ALM adapted to their profile.

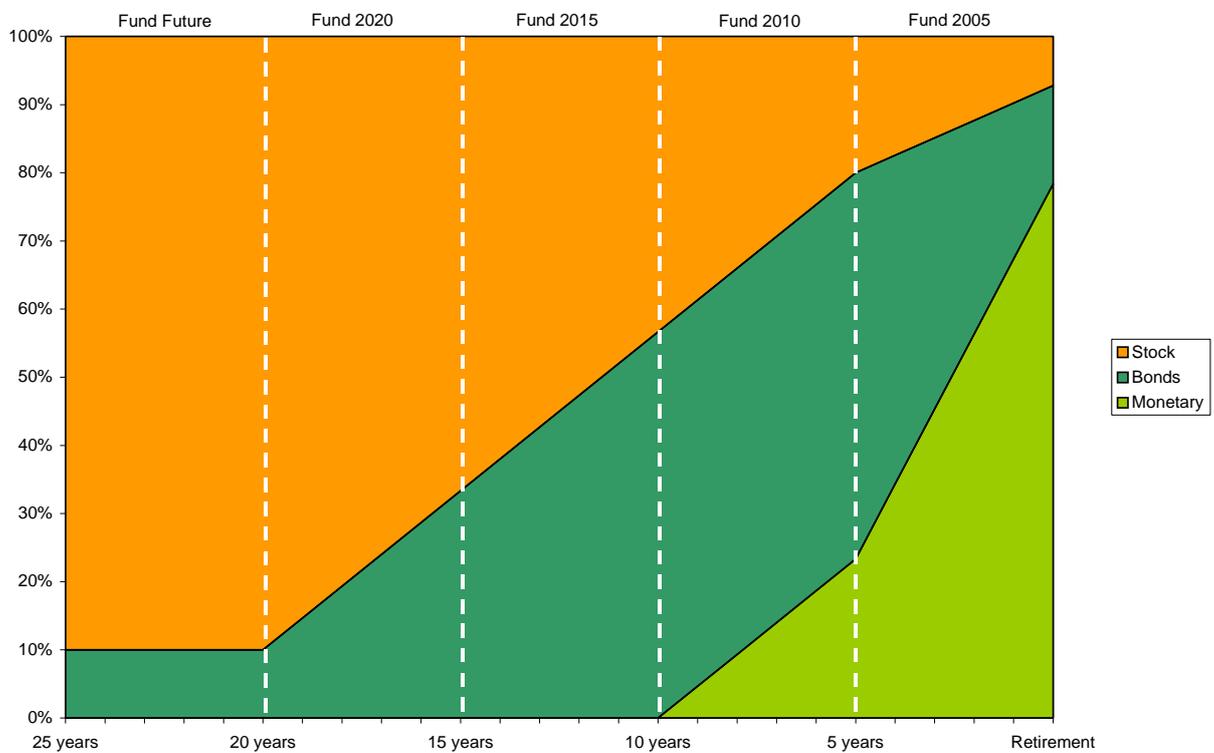
In this ALM one has to take into account their retirement date, their gender, their contribution profile and the type of benefits they want to receive. It has to be simple, available for everybody and easily understandable. You have two ways to adapt the allocation to the age of each insured. The first one would be to create one segregated fund for each residual duration: in this scheme the insured is changing of funds regularly. The second one is described below: you create one fund by generation of people. The allocation of each fund will change continuously.

A generation covers working people who will retire at the same period of time. For example, 5 generations could be defined (Graph 4):

- fund 2005 : people retiring between 1/1/2003 and 31/12/2007
- fund 2010 : people retiring between 1/1/2008 and 31/12/2012
- fund 2015 : people retiring between 1/1/2013 and 31/12/2017
- fund 2020 : people retiring between 1/1/2018 and 31/12/2022
- fund future : people retiring after 1/1/2023.

To adapt each fund to the profile of people of each generation the exposure of each fund to stock will decrease for example by 3/5% per year. Each fund will disappear after the last retirement of the generation. One new fund for young workers will be created every five years.

Graph 4 : Generation of funds



A brief comparison of models:

Most risk management literature and regulatory guidance is preemptive, and focuses on minimizing losses. It offers little advice on how to make money using proactive risk allocation techniques. For Pension Funds, proactive ALM first requires that pension liabilities be incorporated into the asset allocation process. To measure market risk, liabilities can be viewed as negative cash flows projected with some degree of confidence to occur at different points in the future. Many plan sponsors are beginning to be convinced

the actuarial world with the capital markets side of the business by reviewing their true economic risk as the risk to the pension surplus. They can then analyze pension liabilities as a portfolio of zero coupon bonds, making the fund's ALM process analogous to that of a bank or an insurance company.

Of course, ALM for pension funds differs from ALM for financial institutions in that it may require less fixed income immunization and more equity-like investments to match the variability of the uncertainty in liability projections. Still, the principles that commercial and investment banks use to allocate risk adjusted capital daily may be applied to monthly pension fund benchmarking as well.

Further, by benchmarking their lower-returning assets to correlate better with their liabilities, plan sponsors can minimize pension surplus risk. Then they can add higher-returning, more volatile benchmarks to the portfolio without exceeding overall risk limits.

Multiple-factor models, by contrast, decompose risk further by linking macroeconomic variables to the pricing characteristics of capital market and actuarial instruments. These models measure the impact of macroeconomic factors such as inflation, unemployment, corporate bond spreads, commodity prices, foreign exchange rates, GDP growth, and yields on both pension assets and liabilities.

Asset allocation models seek to balance optimal risk and return. The risk side of an optimization may involve variance/covariance estimates of risk, so it does not necessarily entail enormous computational intensity. The return side, meanwhile, requires equilibrium expected returns to start. Since the plan sponsor is often in touch with only a few of the global markets, certain equilibrium returns must be adjusted to reflect his or here market directional views.

The adjacent efficient frontier depicts how increased cash flow matching between assets and liabilities can minimize surplus risk. Instead of choosing the minimal-risk, fully matched strategy, plan sponsors may instead decide on a duration-linking strategy- the mid-range of the frontier which generally allows more room for higher returning, equity-like investments. The reason is that a fully matched pension balance sheet usually results in an expected pension surplus return significantly below the sponsoring company's targeted return on equity.
