PERSPECTIVES ON DYNAMIC ASSET ALLOCATION
Seven Years of Progress
In 2007, BNP Paribas Investment Partners joined with the EDHEC Risk Institute⁴ to initiate a major, long-term research program designed to identify optimal solutions for pension funds seeking to maximize returns and resolve potential frictions inherent in evolving liability structure and investment constraints.

Seven years later, the result is several detailed, high-level academic studies that investigate the significance of dynamic asset allocation strategies in today’s marketplace and provide practical solutions for controlling short-term risk within public and corporate pension plans. We are now pleased to share with you the insights and solutions derived from these efforts. We begin by exploring the most important concepts around which EDHEC’s research is built. We will then focus on the primary findings of this research, with a particular focus on how to build an optimal portfolio that takes into account both the desire for asset growth and the impact of current and future liabilities. Following this, we will explore the practical applications of research findings, including how our investment teams applied the results to develop practical solutions for our clients. Lastly, we will detail the main outcomes of an extensive survey produced by EDHEC as part of the BNP Paribas Investment Partners research chair. This survey, conducted by EDHEC in Q4 2013, assesses the views of pension funds and sponsor companies to dynamic liability-driven investing (LDI) strategies and their current and projected use of these strategies.

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¹ Since 2001, EDHEC Business School has been pursuing an ambitious policy in terms of international research. This policy, known as “Research for Business”, aims to make EDHEC an academic institution of reference for the industry in a small number of areas in which the school has reached critical mass in terms of expertise and research results. Among these areas, asset and risk management have occupied privileged positions, leading to the creation in 2001 of a major research facility: EDHEC-Risk Institute. This institute now boasts a team of 90 permanent professors, engineers and support staff, as well as 48 research associates from the financial industry and affiliate professors.
Basic Concepts and Building Blocks

EDHEC’s stylized framework leads to a profound understanding of the building blocks needed to create an optimal, risk-controlled strategy for pension funds, including the motivation for implementing one that maximizes the probability of achieving its long-term objectives, in view of its short-term constraints. EDHEC is showing that this optimal solution is built around three risk controlling concepts: hedging, diversification and insurance. Their relative importance to the pension fund changes dynamically over time, in line with changing market circumstances and the associated well-being of the pension fund. Linked to these risk-controlling concepts- hedging, diversification and insurance- are three building blocks that fully employ them: a Liability Hedging Portfolio (LHP), a Performance Seeking Portfolio (PSP) and the portfolio’s Downside Protection Strategy (for the funding ratio).

EDHEC defines the LHP building block as the portfolio that has the highest possible return correlation with existing liabilities. In practice, this usually means that the LHP portfolio has a low tracking error with liability returns vis-à-vis low costs. This part links to the hedging concept within the framework.

EDHEC defines the PSP building block as that portfolio which has the highest possible Sharpe ratio over the next short-term review period. Although the PSP is a long-term portfolio, rebalancing the allocation weights of its constituent parts is a continuous process that one needs to keep it in line with short-term developments in the financial markets. Thus, the PSP clearly links to the risk concept of diversification.

Finally, the downside protection block is a collection of risk-controlling strategies (CPPI2-like strategies, OBPI3 or straightforward options on one or more constituent assets of the PSP and/or LHP), which are related to a predefined floor of the funding ratio or a limiting loss. This is a building block EDHEC uses to cope with typical short-term constraints connected to a floor in the funding ratio. Therefore, there is a clear link to the risk concept of insurance.

2 CPPI: Constant Proportion Portfolio Insurance
3 OBPI: Options Based Portfolio Insurance

WHAT DID WE LEARN ABOUT THE OPTIMAL STRATEGY FOR PENSION FUNDS?

There are four key take-aways about the construction of optimal, liability-structured portfolios for institutional clients.
Key take-aways

1. FROM AN ASSET AND LIABILITY MANAGEMENT PERSPECTIVE, IT IS BETTER TO SPLIT THE PENSION FUND PORTFOLIO INTO TWO PARTS, A LIABILITY HEDGING PORTFOLIO (LHP), DESIGNED TO HEDGE LIABILITIES, AND A PERFORMANCE SEEKING PORTFOLIO (PSP), DESIGNED TO CAPTURE UPSIDE POTENTIAL.

Consider a pension fund whose primary objective is to maximize its funding ratio over a long-term investment horizon. As is extensively explored in the literature on long-term investing, the optimal strategy involves a fund separation theorem, reminiscent of the separation theorem in the classic CAPM (Capital Asset Pricing Model) concerning cash and the market portfolio. It legitimizes investing in a liability-hedging portfolio, in addition to the standard performance seeking portfolio.

The main role of the LHP is to “hedge away” the sensitivity of the liabilities to unforeseen changes in systematic factors like interest rates but also credit spreads or inflation or currency, if appropriate. One can eliminate this risk entirely by fully investing in a replication of the liabilities. This, however, is not an optimal strategy for maximizing the long-term funding ratio. Instead, we advocate using the PSP to add extra money to the asset side of the funding ratio via a well-diversified, risk-oriented portfolio. By doing so, the funding ratio is likely to grow as much as possible over time.

A few additional comments on the allocation weights to LHP and PSP are in order. Consider the simplest settings one can imagine. Suppose that the pension fund has no short-term funding ratio constraints and that its financial market opportunity set is constant in time. With the latter, interest rates, volatilities and PSP risk premium are time-invariant. This, then, would imply a “static” LDI allocation, in the sense that its allocation decisions do not directly react either to changing market outlooks, or to changes to its funding ratio. However, this simplified world trivializes the LDI solution, so we really need to be more realistic and relax these settings.

2. IN THE PRESENCE OF A SHORT-TERM FUNDING RATIO CONSTRAINT, IMPLEMENTING AN EXTRA RISK-CONTROLLING DYNAMIC STRATEGY TO PROTECT THE FLOOR OF THE FUNDING RATIO ADDS VALUE TO THE LDI STRATEGY.

In recent times, adverse market conditions have devastated many corporate pension plans. Negative equity market returns eroded plan assets at the same time that declining interest rates increased the mark-to-market value of benefit obligations. Realized and unrealized losses prompted the introduction of formal funding ratio constraints by regulators in most developed countries.

The first and most obvious relaxation is to allow stochastic changes in interest rates. This simple change makes the optimal allocation strategy dynamic. The underlying reason is that the added attractiveness of the PSP (relative to liabilities) now changes with a rise or a fall in interest rates, even though we still assume that the PSP risk premium is constant. The next two takeaways deal with two other relaxations to this stylized, simple world.

Minimum funding ratio constraints virtually demand a dynamic allocation to the performance seeking portfolio (PSP), namely lowering the allocation to the PSP when the funding ratio gets closer to the minimum funding ratio constraint and to increasing it when the funding ratio moves away from it. Here, we see the concept of “insurance”, referred to by EDHEC in its research.

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4 To be more precise, and as it will be indicated in Appendix A, EDHEC assumes that pension funds are maximizing the expected utility of the long-term future funding ratio.

5 In the EDHEC formulas that define the optimal solutions to the weights allocated to LHP and PSP, these weights do not, in general, add up to 100%. Therefore, there is normally a long, and sometimes even a short position in cash in the background.

6 Note in particular that the constant interest rate assumption implies that interest rate risk would be non-existent.
3. IN THE PRESENCE OF MEAN REVERSION OF PSP ASSET RISK PREMIA, TWO COMPETING FORCES DRIVE DYNAMIC ALLOCATION BETWEEN PSP AND LHP.

On one end, dynamic LDI strategies tend to be pro-cyclical: “selling the PSP low” i.e. following a bad performance bringing assets closer to liabilities and “buying the PSP high” i.e. following a good performance rebuilding the cushion of assets relative to liabilities. On the other end, it is precisely when the PSP has gone south that performance is expected to be better, if you assume that asset risk premia are mean reverting. Indeed, the mean reversion in asset risk premia tends to increase the allocation to the PSP anti-cyclically. Likewise, if markets go up, the allocation to PSP will decrease anti-cyclically. This means that, when experiencing a significant loss or gain on the PSP, there are conflicting effects (one pro-cyclical and one anti-cyclical) regarding the relevant allocation between the PSP and the LHP. The EDHEC optimal solution takes into account both effects and actual model parameter settings determine which effect will dominate in the short term.

In case of a mean reverting PSP risk premium, there is still another important side-effect at work. In the optimal solution, the allocation to PSP is namely structurally higher than would be the case without mean reversion. This effect is not difficult to understand by intuition. Mean reversion has namely a favourable effect on the longer term volatility of the PSP, while mean reversion does not materially impact the long run return expectation. Hence, with lower long term risk (the case with mean reversion), a long term investor will want to allocate structurally more to the PSP than when the long term risk would be higher (the case without mean reversion). EDHEC calls this extra allocation to PSP a “hedging” allocation. The structurally higher allocation will namely lead to an extra cushion in the assets value. This hedges-away the negative impacts of unforeseen changes in the PSP risk premium. (Note that this reasoning is comparable to the motive of allocating to the LHP, which serves as a hedge against unforeseen changes in systematic factors like interest rates.)

The anti-cyclical impact of mean reversion on PSP returns is only one reason why an increase in PSP prices should not always lead to an increase in the allocation to the PSP. If we look at this from the utility function of the pension fund, the wealth created beyond a certain level of the funding ratio does not necessarily lead to a substantial increase of utility (utility curves level off when investors wealth increases). Therefore, at some level of the funding ratio, as the cushion relative to its liabilities increases, the pension fund may want to secure gains, rather than keep increasing risk. The introduction in EDHEC’s framework of a formal cap for the funding ratio allows pension funds to decrease the cost of downside risk protection for the funding ratio, while giving up part of the upside potential beyond levels where marginal utility of wealth (relative to liabilities) is low-to-almost zero.

4. DYNAMIC LDI STRATEGIES HELP TO DECREASE CONFLICTS OF INTERESTS BETWEEN THE DIFFERENT STAKEHOLDERS.

Conflicts of interests exist between the various stakeholders of a company with a pension plan, most notably shareholders of the sponsor company, bondholders and beneficiaries of the pension fund (workers and pensioners). To assess such conflicts of interest, EDHEC proposes an integrated model of capital structure where the valuation principles for liabilities streams account for differences in decisions about the financial health and capital structure of the sponsor company level, and to decisions on asset allocation policy at the pension fund level. The existence of a pension plan, for example, is shown to have a strong impact on capital structure decisions and the presence of a pension fund has a substantial impact on debt value and credit ratings.

EDHEC’s research suggests that conflicts of interests could be mitigated by granting pensioners some partial access to any increases in expected performance related to more aggressive investment strategies (cf. conditional indexation rules in the Netherlands). More subtle surplus sharing rules, for example, include the use of hybrid retirement plans and/or the use of contribution holidays for defined benefit plans, both of which would allow equity holders to reduce the burden of contributions, while protecting the interests of pensioners.

EDHEC’s research also found that implementing dynamic LDI strategies is an effective way to align the incentives of shareholders and pensioners, without any complex adjustment to the pension plan structure9.

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7 The presence of short-term floor constraints is not needed for but fortifies this pro-cyclical effect.
8 In absence of mean reversion, the volatility grows with the length of the investment horizon, not linearly but with the square root of the investment horizon. If, for instance, annual returns would have a volatility of 10%, the volatility over a horizon of 16 years would be sqrt(16)*10=40%. If mean reversion is present, the horizon growth factor, sqrt(16) in the example, will become smaller than that. The more mean reversion there is, the smaller the growth factor becomes. So, the 16 year’s volatility will then not be 40% but could, for instance, become 35% or 30%.
9 Note that dynamic LDI strategies can be further improved by taking into account the state of the sponsor company. In particular, risk should be increased when the sponsor company is strong and its bankruptcy risk is low. Conversely, the risk should be decreased when the sponsor company is weaker.
AN OPTIMAL STRATEGY FOR PENSION FUNDS
As discussed earlier, EDHEC’s stylized framework leads to a profound understanding of the building blocks needed to create an optimal strategy for pension funds, including the motivation for holding them. Investing in these building blocks raises practical issues owing to the stylized nature of this framework (see Appendix A for some of these). Therefore, their theory needs to be modified in order to lead to workable investment strategies. To explain how and why, we will look further into the practical aspects of these building blocks.

The liability-hedging component of the framework, the LHP, is never a perfect hedge. It is often implemented via the concept of dollar-duration hedging for interest rates and comparable techniques for credit spreads and inflation. The LHP and the liabilities must then have virtually identical dollar-durations. This usually requires that derivatives are used to supply the LHP with needed long duration for example. One may want to improve upon the duration hedging approach by also taking convexity into account. One way of doing this is by applying cash-flow matching techniques.

The PSP building block relates to the diversification concept of the framework, which is theoretically constructed as a portfolio with the highest possible Sharpe ratio for the next short-term review period. In practice, however, the situation is more complex. For instance, it is not always clear if certain style factors are true risk factors or just market anomalies. How does one allocate to such factors? To what extent is the pension fund willing to take on illiquid assets to increase its Sharpe ratio? Likewise, does the pension fund believe in active management and, if so, how much should be allocated to it to increase the Sharpe ratio?

Finally, a pure funding ratio put is hardly ever used in practice, because such a put is hard to get10. Instead, more partial, ad hoc solutions are applied, such as buying puts on one or more of the funding ratio’s constituent parts (i.e., interest rate swaptions and/or equity puts), or by the application of risk overlays on equity and/or currency investments. Another frequently applied pragmatic alternative to these partial approaches is to replicate the basic idea of the funding ratio put by dynamically changing the allocations to the LHP and PSP. In effect, this means letting the weight allocated to the PSP depend on the distance between the actual funding ratio and its protection level. This is the CPPI-type of implementing portfolio insurance.

INVESTMENT SOLUTIONS THAT WORK IN REAL LIFE
The academic research with EDHEC provides us with the toolkit and the different building blocks needed to build optimal investment solutions for our clients. Real life is (unsurprisingly) different and much more complex than a theoretical framework, especially following recent, substantial, global financial crises, which resulted in a low return environment and increasing regulatory pressure. Long-term investors (such as pension funds) now face a dilemma. On one side, they need to take on risk to meet their future engagement, reduce the future contribution of their sponsor and cover potential risks (e.g. longevity risk for pension funds). However, on the other side, they have to meet short-term constraints dictated by their respective regulators, along with new accounting norms, or even their own internal investment policy.

10 We are only aware of one case where it was applied. Probably not accidentally, it concerned a DB pension fund of which the sponsor was a big general bank with a sizeable investment banking activity.
Our role as asset manager is to reconcile both sides to help our clients reach both their long- and short-term strategic objectives. Forward thinking, practiced in combination with leading edge academic research, allows us to do so.

The following section explores how we build liability-related investment portfolios for our clients. We employ essentially two approaches that are closely linked to the key concepts of the EDHEC framework and the take-aways of the EDHEC research: a Liability Driven Approach (first take-away of EDHEC) and a Dynamic Approach that combines both risk based considerations (second and third take away) and return-based considerations (third take-away).

**A LIABILITY DRIVEN APPROACH**

When we connect an investor’s investment objectives to its liability structure, we usually begin by applying a Liability Driven Investment (LDI) approach. This is particularly true when the liabilities are valued in mark-to-market, as is the case for pension funds in the Netherlands, corporate pension plans under IFRS/IAS 19 accounting norms and, soon, for European insurers under Solvency 2.

In these situations, any move of the discount curve used to value liabilities affects the market valuation of the liabilities and, consequently, creates changes and volatility in the regulatory funding ratio (if assets do not move in tandem with the liabilities). Therefore, we prefer to hedge the risks embedded in the value of the liabilities, unless we have strong conviction on the evolution of the curve. We consider such risks non-rewarding, as they offer no risk premium for taking them. That is exactly the purpose of an LDI approach.

With this approach, we apply the first take-away of the EDHEC research by splitting the assets into two sub-portfolios:

- **A Liability Hedging Portfolio:** including the fixed income assets and interest rate hedge with the aim of matching the sensitivities of the liabilities
- **A Performance Seeking Portfolio:** including all asset classes which aims to generate an excess return relative to liabilities

We construct the Liability Hedging Portfolio (LHP) to hedge non-rewarding risks embedded in the liability valuation, such as interest rate, credit spread, inflation and currency risks (if any). Having a hedging element in the total portfolio offers trustees much better control over the risks connected to the development of their funding ratio. Construction and implementation depends on a number of factors linked to a variety of parameters and requirements (see Appendix B). In every situation, the expertise of an LDI approach manager is particularly valuable, minimizing the risks between the hedging portfolio and the liabilities by taking into account the available instruments, their liquidity and their costs.

Once we reduce the impact of changing liability value, we use the risk budget to invest in rewarding risks embedded in a second portfolio, the Performance Seeking Portfolio (PSP). Our objective here is to provide higher rewards per unit of risk and, by doing so, maximize the expected return of the funding ratio for a given risk budget. The risk level and composition of this PSP depend on the characteristics of the pension fund (i.e., level of funding ratio, risk tolerance, target return, ability of sponsor to contribute further, indexation ambition, and others). Typically, we diversify this return portfolio by investing in equities and other risky assets, which offer a risk premium over return on liabilities. This exercise could also include the use of smart beta approaches and specific risk factors.

As EDHEC clearly defined in its research, adopting a naïve or static LDI approach (such as Buy and Hold allocation or an allocation rebalanced periodically to fixed weights) is not sufficient to manage and control risk properly relative to liabilities. It does not ensure a prompt development of the funding ratio. In practice, not theory, the pension fund has to cope with a number of constraints (obliged by the regulator or the sponsor). Another, and more practical reason is that a static approach eliminates the pension’s ability to grab opportunities that arise in financial markets based on medium-term fundamental developments (such as mean reversion of returns), or short-term Tactical Asset Allocation (TAA) developments that can be fundamental or more event driven. Therefore, a more dynamic approach is much more suitable, leading to better alignment in the allocation to the LHP and the PSP in relation to the funding ratio in different market conditions, but also in its protection of the beneficiaries of a pension fund if it is underfunded. This is fully in line with the findings of EDHEC (see take-aways 2 and 3) and the leading concepts of hedging, diversification and insurance.
Dynamic Asset Allocation within an LDI Approach Framework

Acting dynamically within the liability-hedging portfolio and the performance seeking portfolio, but also between the two sub-portfolios, is part of our institutional investment DNA. Within BNP Paribas Investment Partners, we have implemented dynamic allocation solutions for our clients for more than a decade.

In practice, our dynamic asset allocation is part of a broader asset allocation process where the first step (see following graph) defines a long-term Strategic Asset Allocation within the overall risk appetite of the pension fund. This step gives a basic split between matching assets and exposure to risky assets. From there, we apply a more dynamic asset approach at different stages. In applying this more dynamic approach, we combine both fundamental views on asset classes and systematic risk-based strategies.

Illustration 1: An asset allocation process made of different levels in dynamic asset allocation
MEDIUM AND SHORT-TERM DYNAMIC ALLOCATIONS DRIVEN BY THE RELATIVE ATTRACTIVENESS OF ASSET CLASSES

We assume the markets tend to be more or less efficient over the long run. Nevertheless, on a medium-term horizon, we know that valuations do matter. In such circumstances, maintaining a static allocation would incur opportunity costs. Thus, we implement dynamic allocations for our clients based on fundamental views. The underlying principle in our medium-term asset allocation framework is that risk premia and asset valuations are mean reverting over a full market cycle (typically 5-7 years). This approach favors asset classes we believe are “cheap” over those that we deem “expensive”. Predicting the expected returns of individual asset classes is thus a fundamental part of our approach. We calculate returns by incorporating current yields and valuations, while taking prospective yield and valuation changes into account. This approach applies, more obviously, to the return portfolio, but also to the matching portfolio and the way we have divided assets between PSP and LHP. So, if, in a low yield environment, we are convinced of an interest rate increase (based on fundamentals and central bank policies), we may work with our clients to reduce their interest rate hedging ratio by reducing the duration of the portfolio. To ensure our allocation remains optimal in terms of risk and return, it is important to do this allocation exercise periodically. We usually advise doing it at least on an annual basis to take into account timely market developments, or eventual changes in the specific situation of the pension fund.

Finally, we consider the relative attractiveness of asset classes on a short-term basis, based on fundamentals, market inefficiencies, or changes of market regimes and events. To benefit from those opportunities, we offer the opportunity to add a Tactical Asset Allocation (TAA) strategy. This would make the allocation even more dynamic, because TAA strategies usually have a short-term horizon (3-12 months). For both types of asset allocation policies, we need part of the risk budget available, because both are or can be alpha sources that can deliver an additional return over the Strategic Asset Allocation.

A DYNAMIC RISK ALLOCATION BASED ON SYSTEMATIC RULES

While we apply a more fundamental dynamic approach to optimize the risk/return characteristics of the portfolio versus its liabilities, we strongly believe and our experience supports the conclusion that a dynamic allocation strategy based on systematic rules is a more suitable way to reconcile the long-term objectives of our clients with their short-term constraints, at the least from a protection (or insurance) point of view. Although fundamental ideas can be instrumental in decisions to “de-risk” or “re-risk”, we feel that complying with short-term (often regulatory driven) constraints needs the more disciplined approach found in the form of a rule-based strategy. When implementing such a dynamic, rule-based risk strategy for pension funds, our target is to establish a relationship between the level of funding ratio and the available risk budget (often referred to as a “buffer”), as opposed to a defined minimum funding ratio. This strategy is effectively a kind of algorithm for the use of the risk budget under changing circumstances. We review this process on an annual basis, in most cases.

Illustration 2 shows an imaginary path, one that is typical for a number of our Dutch clients. It shows that the allocation to the PSP is relatively low for relatively low funding ratio levels, leading to a lower overall risk. For relatively high funding ratios, the allocation to the return portfolio increases. In between, the slope of the relationship between PSP and funding level can differ to take into account specific milestones. In this example, the allocation to the performance seeking portfolio doesn’t go to 0%, something that is possible in the more stylized approach of EDHEC. In practice, pension funds invest in more illiquid asset classes, making it impossible to bring down quickly the exposure to the PSP completely to 0% in a relatively short period. This can be a deliberate choice of the pension fund, because these illiquid asset classes usually have an attractive risk/liquidity premium earned in future on the somewhat longer maturity. An alignment of interest and an understanding of the strategy of all stakeholders (beneficiaries of the pension fund, sponsors and even regulators) can help mitigate some of the possible negative short-term consequences. Keeping some exposure to risky assets to benefit from a potential upside in markets could be another reason to keep a certain allocation to the PSP.

In practice, we also introduce boundaries around the targeted levels (represented by the dash lines in our illustration) for efficient implementation of the dynamic strategy, as doing so prevents continuous trading when funding ratios are moving. For example, we adjust the allocation to the performance seeking portfolio only if, at the moment of measuring the allocation, our hedge is outside the boundaries. Usually, we look at the portfolio every month or every three months. If the portfolio is outside the boundaries, we rebalance.

Illustration 2: Allocation to performance seeking portfolio in function of funding level for a real client case

Source: BNP Paribas Investment Partners

This is just one of many types of dynamic risk-based strategies. We manage a range of strategies, tailor-made to the specific objectives of the client, such as, for example, the protection of a defined funding ratio level, or the maintenance of a volatility/VaR target level for the funding ratio. For the latter, we develop dedicated algorithms to meet specific requirements. To avoid breaching the defined targets, we might adjust the allocation more frequently (daily or weekly, as called for) than in the case presented here. Within those solutions, the risk motive will always dominate the fundamental views.

In terms of implementation, we favor applying these strategies under the form of an overlay, via derivatives, to avoid interfering with underlying investments. This requires a deep knowledge of the derivatives market to ensure the best trade-off between the quality of hedging (compared to the underlying asset), the cost of trading such instruments and their liquidity. We do this daily, with dedicated resources applied to ensure the accuracy and facility of this operation.
What is the reality on the ground? The EDHEC survey and our views

The fifth and final paper produced by EDHEC Risk Institute as part of the BNP Paribas Investment Partners research chair on “Asset-Liability Management and Institutional Investment Management,” is a survey of 104 pension funds and sponsor companies (of which the large majority are European pension funds) to obtain their current views about and use (if any) of LDI and Dynamic LDI strategies. The four key messages taken out of the survey are:

1. The survey found that participants are very familiar with the LDI paradigm, but the rate of adoption is limited. In concrete terms, not enough pension funds have applied the fund separation approach (LHP/PSP) to manage the LDI approach optimally, especially in southern European countries. In the same way, it appears that pensions measure liability risk more often than they managed it. In fact, pension funds do not always implement the hedging of the duration of the liabilities, even though they affirm that they use LDI-type solutions.

2. The risk allocation approach, with its innovative offerings in the area of factor investing in recent years, is gaining ground, primarily because it contributes to a better understanding of institutional investors’ risks and diversification. From that perspective, we can see an acceleration in its adoption by professionals, as academic interest is rapidly growing.

3. Too many pension funds are more concerned with standalone performance than risk management, which explains why pension funds implement Dynamic LDI strategies more for fundamental or tactical reasons than for risk management or funding ratio protection. Most respondents do not translate the minimum funding requirements imposed by regulation into floor protections: more than half of participants recognize that they operate under such constraints, but hardly a fifth of them impose boundaries. We also observed a clear difference in the rates of adoption of dynamic LDI between the north and the south of Europe. The difference between North and South is because the South of Europe has no regulation imposing a mark-to-market for liabilities, which also explains why LDI is not applied.

4. A majority of the respondents recognize the presence of conflicts of interest between various stakeholders, while slightly less than half of the respondents have taken steps toward an integrated approach to pension fund asset-liability management, if only by adopting some form of hedging mechanism against sponsor risk.

In summary, we think that too many pension funds remain asset-only rather than Asset Liability Management (ALM) driven and do not take into sufficient account the impact of their liabilities in their asset allocation policy or risk management. The reasons that could partially explain this situation are:

- In some countries, the LDI concept is relatively new and trustees may see the move to LDI as a risk, one that takes them out of their comfort zone. That is why, as an asset manager, we have to educate the market about the risks of not adopting such an approach, especially for corporate pension plans, where an underfunded situation could affect the sponsor balance sheet and may have an important effect on their credit rating and dividend policy. This is also the case for pension funds where local regulation imposes a mark-to-market of liabilities, with minimum funding ratio constraints.

- In other countries, where pension funds may better understand the LDI concept, there could be some reluctance to embrace LDI due to the current yield environment. Indeed, adopting a LDI strategy at this stage would lock up pension funds with very low rates, while if they keep their existing duration mismatch, they could benefit from an interest rate increase and improve their funding ratio. We disagree. Splitting the portfolio into two parts (a LHP portfolio and a PSP portfolio) should be applied in any interest rate environment, while the level of interest rate hedge should be adapted to the specific market circumstances (e.g., if strong conviction of an interest rate rise, the percentage of interest rate hedging could be lowered).

- Finally, some pension funds are still managing their portfolios against a classic benchmark instead of a liability benchmark. Not using the latter makes the use of an LDI approach less obvious. We think that if liabilities are valued in mark-to-market, rigorous risk management is unachievable without implementing an LDI approach. Once again, we need to educate the market further to change this mentality.
Survey: Key facts and figures

PROFILE OF RESPONDENTS

Respondents
- 90% Pension funds
- 10% Sponsor company

Region
- 87% Europe
- 13% Other

Pension Fund Type
- 62% Defined Benefit (DB) funds
- 19% Defined Contribution (DC) funds
- 19% Hybrid funds

Discounted Liabilities
- 47% Market rate
- 24% Fixed rate
- 29% Others

Size
- 86% above 1 Billion Euro
- 34% above 10 Billion Euro

LDI ADOPTION

- **80%** familiar with LDI paradigm.
  - Majority measures risk against liabilities through shortfall probability and expected shortfall
  - However, only **49%** split their portfolio into Liability Hedging Portfolio (LHP) and Performance Seeking Portfolio (PSP)
  - Reasons for splitting portfolio:
    - Simplification of the portfolio construction process
    - Simplification of the reporting with simple indicators

- **Only 46%** hedge their liabilities
  - **Liability risk** is measured more often than hedged

- **54%** of the pension funds that don’t hedge liabilities define their asset allocation by:
  - Achieving the highest performance subject to general risk constraints
  - Achieving the highest performance subject to liability constraints

Percentage figures are rounded

Source: EDHEC Risk Institute Publication - Dynamic Liability-Driven Investing Strategies: The Emergence of a New Investment Paradigm for Pension Funds? (A survey of the LDI practices for pension funds), February 2014
LHP IMPLEMENTATION

- **DURATION**: 40% align the duration in their LHP with the duration of liabilities
  - Implementation constraints are a main reason for the remaining 60% of pension funds who don’t align duration

- **COMPOSITION**:
  - 12% Bonds
  - 59% Bonds and Fixed Income derivatives
  - 12% commodities and/or other Real Assets
  - 16% equities
  - **Type of bonds for LHP**: 28% Treasury Bonds, 3% Corporate Bonds and 69% Both

- **LEVERAGE**:
  - 34% use leverage as part of their LDI strategy:
    - **WHY?** the instruments used in LHP imply some amount of leverage (53%), it reconciles the focus on hedging liabilities and the focus on seeking performance (23%), leverage is a means to meet their liability commitments (13%), remaining 10% gave other reasons
  - 66% don’t use leverage:
    - **WHY?** Leverage is not allowed due to regulation and/or their board (42%), leverage is not consistent with their risk management (26%), the purpose of the LHP should not be to speculate on IR (9%), remaining (23%) gave other reasons

- **Implementation**: Use of derivatives for 90% and cash-based solutions for 10%

PSP IMPLEMENTATION

- **RISK ALLOCATION**:
  - 35% frame their asset allocation in PSP in terms of factors vs, or in addition to, framing it in terms of asset classes
  - **WHY?** It forces them to call into question the performance and risks of various asset classes
    - 67%, the risk factor approach is more meaningful than an asset allocation approach (15%), the approach is consistent with the investment in passive vehicles 9%, the remaining (9%) gave other reasons.

Percentage figures are rounded

Source: EDHEC Risk Institute Publication - Dynamic Liability-Driven Investing Strategies: The Emergence of a New Investment Paradigm for Pension Funds? (A survey of the LDI practices for pension funds), February 2014
DYNAMIC LDI (DLDI)

- **DLDI: circa 40%**
  - **WHY?** It reacts to contemporaneous changes in market conditions (33%), it performs risk management and reduces risk taking when approaching floor levels (28%), for tactical considerations based on active views on future asset class returns (28%), it complies with prudential regulation (8%), others (3%)

*Figure: DLDI Implementation*

- **ALTERNATIVES to Dynamic LDI:**
  - Derivatives to hedge downside risk
  - Absolute Return strategies
  - Strategies targeting a return linked to inflation
  - Constant Proportion Portfolio Insurance
  - Guaranteed Return Strategies

INTEGRATED LDI

- **Limited awareness of sponsor risk:**
  - 34% assess the probability of default of the sponsor

- **Hedge against sponsor risk (multiple responses per participant were allowed):**
  - 58% do not take into account the sponsor risk
  - 18% takes into account the risk of default by the sponsor
  - 12% takes into account the risk that the sponsor cannot raise contribution
  - 15% incorporates information about risk factors impacting the sponsor's financial
  - 8% fully models the sponsor risk in their integrated ALM approach

Percentage figures are rounded

*Source: EDHEC Risk Institute Publication - Dynamic Liability-Driven Investing Strategies: The Emergence of a New Investment Paradigm for Pension Funds? (A survey of the LDI practices for pension funds), February 2014*
In the context of the BNP Paribas Investment Partners chair with EDHEC on “Asset and Liability Management and Institutional Investment Management”, five research papers on optimal solutions for pension funds have been published:

- Measuring the Benefits of Dynamic Asset Allocation Strategies in the Presence of Liability Constraints
- Dynamic Investment Strategies for Corporate Pension Funds in the Presence of Sponsor Risk
- Hedging versus Insurance: Long-Horizon Investing with Short-Term Constraints
- Dynamic Liability-Driven Investing Strategies: The Emergence of a New Investment Paradigm for Pension Funds? (A survey of the LDI practices for pension funds)

To discuss these findings, to receive soft copies of the above mentioned papers or to receive further information on BNPP IP’s Customized Solutions offering, please contact:

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APPENDIX A
EDHEC’s stylized framework versus practice

- The pension fund is assumed to optimize the risk/return trade-off via a utility function, with the funding ratio and the fund’s risk-aversion as inputs. In practice, most pension funds do not work with utility functions. Rather than looking for the optimal solution in terms of maximal expected utility, pension funds tend to look for a practical solution by applying customized heuristic multi-criteria evaluation frameworks.

- The liabilities are assumed to be fixed, lump sum payments “H” years from now, after which the pension fund is terminated. Any surplus goes to the sponsor company. In practice, pension funds have dispersed liabilities and generally do not have clear termination dates.

- In EDHEC’s model, floor protection can be thought of as buying a “put” option on the funding ratio, with the floor protection level serving as the exercise price. One may construct the put option via a CPPI-like strategy.

- The pension fund is assumed to invest only in a limited number of assets (bonds and equities). In practice, pension funds invest in a much wider set of assets.

- Trading is assumed to take place without any practical issues. In practice, trading takes time and market impacts can be large. This is true particularly in the case of illiquid assets and/or when trading sizes are large (even when the asset is normally regarded as liquid, a large pension fund can easily encounter market impacts).

- Markets are assumed to be efficient. In practice, the absolute validity of this assumption is disputed, and many pension funds allocate some of their assets to active strategies.

APPENDIX B
Implementation of Liability Hedging Portfolio

In reality, the composition of the liability hedging portfolio can diverge massively from one client to the other, even if the underlying objective is the same. The key factors influencing the composition of such a portfolio are:

1. The discount curve. Next to the obvious characteristics of the liabilities maturity distribution, the discount curve is one of the first factors to consider. We illustrate this with two examples:
   - Example 1: Under the Dutch pension fund regulation, the discount curve is based on the Euro swap curve. In this specific case, the hedging portfolio will then be constructed with the help of long duration interest rate swaps.
   - Example 2: Under IFRS/IAS 19 accounting norms, the discount rate is based on the AA credit curve. This implies the hedging portfolio will be primarily invested in credit in order to replicate the spread sensitivity.

2. Possible investments in derivatives. Investing in derivatives is particularly interesting as it allows us to increase duration via Listed Futures or Interest Rate Swaps or Swaptions. In this last case, LHP duration is increased at the right time, namely when interest rates drop, but the benefits to the funding ratio when rates rise are not affected. This makes sense in an environment where interest rates are low and the chance of an increase exists. Using derivatives (leverage) is also a means to free cash in order to invest more in the PSP portfolio to reduce future costs to the pension funds.

3. The size of the pension plan. For large plans, we usually customize the hedging portfolio to each specific situation, while for smaller plans, we provide access to a LDI approach via pooled vehicles (leveraged, or not) allowing us to best replicate the structure of their liabilities.
Who We Are

BNP Paribas Investment Partners is the seventh largest European asset manager with Euros 488 billion in assets under management\textsuperscript{11}.

Solvency/Risk Management issues require tailor-made solutions, as each institutional investor’s situation and specific constraints are unique. Within BNP Paribas Investment Partners, we have our Customized and Fiduciary Management team, working in close cooperation with our Financial Engineering team, focusing on the design and management of tailored solutions answering the specific needs of each client. Those solutions range from full fledge fiduciary solutions (holistic approach including various building blocks such as liability driven portfolios) to risk overlays. Depending on the type of solution, our Customized and Fiduciary Management team works with experts in complementary fields from across the organisation to develop ad-hoc solutions.

Our Customized and Fiduciary Management team has more than a decade of experience working with Dutch pension funds, which are known as some of the most sophisticated pension funds in the world. The solutions the team proposes now go beyond the Netherlands, thanks to strong adaptation capabilities to specific local constraints.

\textsuperscript{11} As of 31 March, 2014

Source: BNP Paribas Group
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