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INSIGHTS

"Insights" features the thoughts and views of the top authorities from academia and the profession. This section offers unique perspectives from the leading minds in investment management.

MASS CUSTOMIZATION VERSUS MASS PRODUCTION – HOW AN INDUSTRIAL REVOLUTION IS ABOUT TO TAKE PLACE IN MONEY MANAGEMENT AND WHY IT INVOLVES A SHIFT FROM INVESTMENT PRODUCTS TO INVESTMENT SOLUTIONS

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While mass production has happened a long time ago in investment management through the introduction of mutual funds and more recently exchange traded funds, a new industrial revolution is currently under way, which involves mass customization, a production and distribution technique that will allow individual investors to gain access to scalable and cost-efficient forms of goal-based investing solutions.

1 New challenges in institutional and individual money management

Over the last 15 years or so, the investment industry has experienced a series of profound structural changes, and an increasing number of serious new challenges are being faced by both institutional and individual investors as a result of these changes.

On the institutional side, pension funds have been particularly impacted by the shift in most accounting standards towards the valuation of pension liabilities at market rates, instead of fixed discount rates, which has resulted in an increased volatility for pension liability portfolios (see Fabozzi *et al.*, 2014 for a discussion of pension liability discounting rules). This new constraint has been reinforced in parallel by stricter solvency requirements that followed the 2000–2003 pension fund crisis, while ever stricter solvency requirements are also increasingly imposed in US, Europe and Asia to insurance companies.

This evolution in accounting and prudential regulations have subsequently led a large number of corporations to close their defined-benefit pension schemes so as to reduce the impact of pension liability risk on their balance sheet and

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income statement. Overall, a massive shift from defined-benefit pension to defined-contribution pension schemes is taking place across the world. Consequently, individuals are becoming increasingly responsible for making investment decisions related to their retirement financing needs, investment decisions that they are not equipped to deal with, given the low levels of financial literacy within the general population and the reported inability of financial education to significantly improve upon the current situation (Fernandes *et al.*, 2014.

In such a fast-changing environment and increasingly challenging context, the need for the investment industry to evolve beyond standard product-based market-centered approaches and to start providing both institutions and individuals with meaningful investor-centric investment solutions has become more obvious than ever.

2 The death of the policy portfolio and the emergence of liability-driven investing and factor investing in institutional money management

To get a better sense for how the investment process critically needs to evolve, I will first discuss the standard long-term investment approach widely adopted in institutional money management practice. In this traditional approach, asset allocation practices are firmly grounded around one overarching foundational concept, the *policy portfolio*, a theoretical reference portfolio allocated among asset classes according to a mix deemed to be most appropriate for the investor. The first step of the investment process therefore consists in grouping individual securities in somewhat arbitrary asset classes or sub-classes according to several dimensions such as equity versus debt, and then country, sector and/or style within the equity universe, or country, maturity and credit rating within the bond universe. Once a centralized decision maker (e.g., a pension fund chief investment officer) has decided how much capital should be allocated to the different asset classes and sub-classes, one or more internal or external asset managers are then expected in a second step to decide how to allocate the funds made available to the individual securities within the corresponding asset class (see van Binsbergen *et al.*, 2008 for a recent analysis of the efficiency loss involved in this two-step process).

In a nutshell, the key sources of added value in the investment process according to the old paradigm are (1) the ability to design a meaningful policy portfolio, and (2) the ability to select the right managers, who themselves are expected to demonstrate an ability to select the right securities (case of active managers) or accurately replicate an arbitrary index chosen as a benchmark (case of passive managers). In the face of the aforementioned profound structural changes, this old paradigm has progressively been recognized as a purely functional obsolete method for organizing the investment process, which is somewhat orthogonal to the needs of investors. Because of its sole focus on market risks (risks embedded within asset classes benchmarks and associated investment managers), the traditional approach fails to account for what is the only relevant risk for institutional and individual investors, namely the risk of not achieving their meaningful goals. The need to move away from the old paradigm is progressively surfacing on many apparently distinct dimensions, which I argue start to form a coherent whole new investment framework when carefully examined.

The first driving force behind the paradigm change that has taken place in institutional money management over the last 15 years has been the progressive recognition that pension fund investments should not be framed in terms of one all-encompassing reference policy portfolio, but instead in terms of two distinct reference

portfolios (see for example Martellini, 2006). These two portfolios are, respectively, a liability-hedging portfolio (LHP), the sole purpose of which is to hedge away as effectively as possible the impact of unexpected changes in risk factors affecting liability values (most notably interest rate and inflation risks), and a performance-seeking portfolio (PSP), which focuses on providing investors with an efficient harvesting or risk premia, without any constraints related to a possible liability mismatch.

This dual portfolio approach is consistent with the "fund separation theorems", which lie at the core of asset pricing theory since Tobin (1958) and which advocate a separate management of performance and risk control objectives, extended to an asset-liability management context. More generally, and regardless of the exact form of implementation of what is now known as *liability-driven investing* (also known as liability-directed investing), and this change has led to an increased focus on liability risk management, which is precisely a first step towards properly accounting for an institutional investor's meaningful objective, and the risk factors that impact the probability for the objective to be achieved.

The *death of the policy portfolio*, the first pillar of the old investment paradigm, has actually been announced, or rather predicted, by Peter Bernstein as early as 2003 in "Economics and Portfolio Strategy" newsletter, independently of the emergence of an increased focus on liability risk management. This early announcement has resulted from the recognition that there is no such thing as a meaningful policy portfolio—one should instead think in terms of a meaningful dynamic policy portfolio *strategy*. The claim here is that the need to react to changes in market conditions as well as changes in margin for error with respect to investors' most important goals invalidates the relevance of any optimal portfolio that would be held constant for a sustained period of time (Merton, 1971). When transported to an asset-liability context, this recognition leads to the emergence of *dynamic*, as opposed to *static*, liability-driven investing (see Badaoui *et al.*, 2014 for more details on the benefits of such strategies and its adoption by sophisticated institutional investors).

In parallel to the emergence of dynamic liability-driven investing, the second driving force behind the paradigm change is the progressive adoption of a new approach known as factor investing, which has recently emerged in investment practice and which recommends that allocation decisions be expressed in terms of risk factors, as opposed to standard asset class decompositions. There again, the focus is to move away from a market-centric perspective towards an investor-centric perspective, which should start with a thorough analysis and proper understanding of the risk factors that have a meaningful influence on the probability for asset owners to achieve their goals.

This evolution has brought a fatal blow to the second pillar of the old investment paradigm, namely the focus on manager selection. Indeed, while risk factors have long been used for risk and performance evaluation of actively managed portfolios, the growing interest amongst sophisticated institutional investors in risk allocation and factor investing (Ang, 2014; Martellini and Milhau, 2015) leads to a disciplined approach to portfolio management that is meant to allow investors to harvest risk premia across and within asset classes through liquid and cost-efficient systematic strategies *without* having to invest with active managers (see in particular Ang *et al.*, 2009 analysis of the Norwegian Government Pension Fund Global).

In this context, the emergence of *smart beta* investment solutions is blurring the traditional clear-cut split between active versus passive

equity portfolio management (see for example Amenc *et al.*, 2012) and *smart factor indices*, formally defined as efficient and well-diversified replicating portfolios for rewarded risk factors, now form a basis of cost-efficient investment vehicles that can be used by institutional investors to harvest traditional and alternative risk premia (see Amenc *et al.*, 2014).

3 The evolution from mass customization to mass production and the emergence of goal-based investing in individual money management

While these developments have started in institutional money management, I view as a critically important challenge the need to transport them to individual money management, where the massive shift of retirement risks on individuals is giving the investment management industry a great responsibility in terms of how to provide households with suitable retirement solutions. Investment management is actually justified as an industry only to the extent that it can demonstrate a capacity of adding value through the design of meaningful investment solutions that allow investors' to meet their meaningful goals.

Unfortunately, currently available investment options hardly provide a satisfying answer to the retirement investment challenge, and most individuals are left with an unsatisfying choice between on the one hand safe strategies with very limited upside potential, which will not allow them to generate the kind of *target* replacement income they need in retirement, and on the other hand risky strategies offering no security with respect to *minimum* levels of replacement income (see for example Bodie *et al.*, 2010 for an analysis of the risks involved in target date fund investments in a retirement context).

This stands in contrast with a well-designed retirement solution that would allow individual investors to secure the kind of replacement income in retirement needed to meet their *essential* consumption goals, while generating a relatively high probability for them to achieve their *aspirational* consumption goals, with possible additional goals including healthcare, old age care, and/or bequest.

I argue that some dramatic changes with respect to existing investment practices are needed to facilitate the development of such meaningful retirement solutions. Just as in institutional money management, the need to design an asset allocation solution that is a function of the kinds of particular risks to which the investor is exposed, or needs to be exposed to meet liabilities or fulfill goals, as opposed to purely focusing on the risks impacting the market as a whole, makes standard approaches, based on balanced portfolios invested in a mixture of asset class portfolios actively and passively managed against market benchmarks mostly inadequate.

This recognition is leading to a new investment paradigm, which has been labeled *goal-based investing* (GBI) in individual money management (see Chhabra, 2005), where investors' problems can be fully characterized in terms of their lifetime meaningful goals (see Lopes, 1987 for an analysis of investors' aspirational goals throughout their life cycle), just as *liability-driven investing* (LDI) has become the relevant paradigm in institutional money management, where investors' problems are broadly summarized in terms of their liabilities.

In a nutshell, goal-based investing includes two distinct elements (see Deguest *et al.*, 2015 for a detailed analysis). On the one hand, it involves disaggregation of investor preferences into a hierarchical list of goals, with a key distinction between *essential* and *aspirational* goals, and the mapping of these groups to hedging portfolios possessing corresponding risk characteristics. On

the other hand it involves an efficient dynamic allocation to these dedicated hedging portfolios and a common performance-seeking portfolio. In this sense, the goal-based investing approach is formally consistent with the fund separation theorems that serve as founding pillars for dynamic asset pricing theory, just as was the case for the liability-driven investing approach (see also Shefrin and Statman, 2000; Das *et al.*, 2010 for an analysis of the relationship between modern portfolio theory portfolio optimization with mental accounts in a static setting).

4 The relationship between dynamic asset pricing theory and goal-based investing

More precisely, the first output of the framework consists in designing for each essential goal a goal-hedging portfolio (GHP in short). The general objective assigned to this portfolio is to secure the goal with certainty and does so at the cheapest cost. Its exact nature depends on the type of goal under consideration. For a retirement goal, the goal-hedging portfolio is typically an inflation-linked annuity (or a suitably-defined dynamic replicating portfolio for an inflation-linked annuity) that will pay the inflation-protected required level of replacement income in retirement. In addition to financing hedging portfolios associated with all essential goals, the investor also needs to generate performance so as to reach aspirational goals with a non-zero probability. In this context, investors should allocate some fraction of their assets to a well-diversified performance-seeking portfolio in an attempt to harvest risk premia on risky assets across financial markets, as was also advocated in institutional money management under the liability-driven investing paradigm.

One natural benchmark strategy consists in securing all essential goals, and investing the available liquid wealth in a performance portfolio allowing for the most efficient harvesting of market risk premia. This strategy, which is appealing since it secures essential goals with probability 1 and generates some upside potential required for the achievement of important and aspirational goals, is in fact a specific case of a wider class of (in general) *dynamic* goals-based investing strategies.

These strategies advocate that the allocation to the safe (with respect to investors' goals) versus risky portfolio should be taken as some function of the current wealth level and the present value of the fraction of essential goals that is not financed by future cash in-flows, with the key property that this function, whose parameters in general depend on market conditions, should converge to zero when wealth levels converge to levels required for securing essential goals.

From a formal standpoint, the problem can be handled via the so-called *convex duality* or *martingale* approach to dynamic asset allocation problems (Karatzas *et al.*, 1987; Cox and Huang, 1989) where one first defines an optimal state-contingent wealth for investors, given their long-term goals and constraints, and then obtains the optimal dynamic asset allocation strategy as the dynamic replicating portfolio strategy for the non-linear contingent payoff.

I emphasize that the framework should not only be thought as a financial engineering device for generating meaningful investment solutions with respect to investors' needs. It should also, and perhaps even more importantly, encompass a process dedicated to facilitating a meaningful dialogue with the investor. In this context, the reporting dimension of the framework should focus on updated probabilities of achieving investors' meaningful goals and associated expected shortfalls, as opposed to solely focusing on standard risk and return indicators, which are mostly irrelevant in this context.

At the risk of stating the obvious, let me again state the fact that institutional and individual investors alike are facing complex problems, emphasized by the aforementioned recent changes in the retirement landscape, for which they need dedicated investment solutions, as opposed to off-the-shelf investment products. These problems can be broadly summarized by the need to finance substantial levels of consumption with relatively limited dollar budgets (limited contributions from the beneficiaries and/or their sponsors) as well as relatively limited (regulatory- or self-imposed) risk budgets. Against this backdrop, I would propose the following definition of *investment management as the art and science of efficiently spending investors' dollar and risk budgets through a disciplined use of the three forms of risk management*, namely risk *hedging* (for an efficient control of the risk factors in investors' liabilities/goals), *diversification* (for an efficient harvesting of risk premia), and insurance (for securing investors essential goals while generative attractive probabilities to reach their aspirational goals).

While each of these sources of value added is already used to some extend in different contexts, I argue that a comprehensive integration of all these elements within a comprehensive disciplined investment management framework is required for the design of meaningful investment solutions (see Merton and Bodie, 1995 for a discussion of the three forms of risk management and their relationship with the functions of the financial system).

5 The true start of the industrial revolution in investment management

Mass production (as in *product*) has happened a long time ago in investment management through the introduction of mutual funds and more recently exchange-traded funds. I would argue that what will trigger the true start of the industrial revolution is instead *mass customization* (as in *customized* solution), which by definition is a manufacturing *and* distribution technique that combines the flexibility and personalization of "custom-made" with the low unit costs associated with mass production. The true challenge is indeed to find a way to provide a large number of individual investors with meaningful dedicated investment solutions.

Within Modern Portfolio Theory, mass customization is trivialized: if investors' problems can be fully characterized by a simple risk-aversion parameter, then the aforementioned fund separation theorems state that all investors need to hold a *specific* combination of two *common* funds, one risky fund used for risk premia harvesting, and one safe (money market) fund. In reality different investors have different goals, as discussed above, and the suitable extension of the fund separation theorems implies that if the performance-seeking building block can be the same for all investors, the safe building block(s), which are known as goal-hedging portfolio(s) and are the exact counterparts in individual money management of liability-hedging portfolios in institutional money management, should be (mass) customized. Besides, the allocation to the safe versus risky building blocks should also be engineered so as to secure investors' *essential* goals (e.g., *minimum* levels of replacement income) while generating a relatively high probability to achieve their *aspirational* goals (e.g., *target* levels of replacement income).

That mass customization is the key challenge that our industry is facing has been recognized long ago, but it is only recently that we have developed the actual capacity to provide such dedicated investment solutions to individuals. This point has been made very explicitly in Merton (2003): "It is, of course, not new to say that optimal investment policy should not be "one size fits all". In current

practice, however, there is much more uniformity in advice than is necessary with existing financial thinking and technology. That is, investment managers and advisors have a much richer set of tools available to them than they traditionally use for clients. (· · ·) I see this issue as a tough engineering problem, not one of new science. We know how to approach it in principle (· · ·) but actually doing it is the challenge".

Paraphrasing Robert Merton, I would like to emphasize that designing meaningful retirement solutions does not indeed require *a new science*. I have actually argued in this paper that all the required ingredients are perfectly well understood in the context of dynamic asset pricing theory (see for example Duffie, 2001), namely (1) a safe (goal-hedging) portfolio that should be truly safe; (2) a risky (performance-seeking) portfolio that should be well rewarded; and (3) an allocation to the risky portfolio that (3(i)) reacts to changes in market conditions and (3(ii)) secures investors' essential goals (EGs) while generating a high probability of reaching aspirational goals (AG).

On the other hand, scalability constraints required to address mass customization do pose a *tough engineering challenge*, since it is hardly feasible to launch a customized dynamic allocation strategy for each individual investor. There are in fact two distinct dimensions of scalability: scalability with respect to the *cross-sectional dimension* (designing a dynamic strategy that can approximately accommodate the needs of different investors entering at the same point in time), and scalability with respect to the *time-series dimension* (designing a dynamic strategy that can approximately accommodate the needs of different investors entering at different points in time). The good news is that financial engineering can be used to meet these challenges (see Martellini and Milhau, 2015 for a detailed analysis).

In conclusion, let me state that the magnitude of what is happening should not be under-estimated. I do believe that our industry is truly about to experience something that looks like an industrial revolution, an industrial revolution which will take place within the next 5–10 years. We currently are at the confluence of historically powerful forces. On the one hand, liquid and transparent access to risk premia harvesting portfolios is now feasible with smart factor indices, which are cost-efficient and scalable alternatives to active managers. On the other hand, distribution costs are bound to go down from their stratospheric levels as the trend towards *disintermediation* is accelerating through the development of FinTech and robo-advisor initiatives, which are putting the old business model under strong pressure, and forcing wealth management firms to entirely rethink the value that they are bringing to their clients.

Risk management, defined as the ability for investors, or asset and wealth managers acting on their behalf, to efficiently spend their dollar and risk budgets so as to enhance the probability to reach their meaningful goals, will play a central role in this industrial revolution that will eventually lead to scalable, cost-efficient, investor-centric, welfare-improving investment solutions. Sophisticated financial engineering techniques have been used in the past to hide fees and risks within complex products that were sold to investors as safe and inexpensive products, and which were anyway entirely irrelevant with respect to investors' meaningful goals. It is about time that we use the same financial engineering techniques to help investors meet the most important challenges that they face, including the retirement financing challenge.

What it takes for wealth and asset management firms to take an active role in this new investment paradigm is the combination of two relatively new ingredients. First they should internalize financial

engineering expertise that is typically most commonly found in investment banking, namely the expertise needed to design state-contingent payoffs and efficient dynamic replicating portfolios for these payoffs. The convergence between investment management expertise, where a substantial amount of accumulated knowledge can be found about how to efficiently harvest risk premia, and investment banking expertise, where a substantial amount of accumulated knowledge can be found about how to efficiently structure underlying risk exposures, is a key central requirement for this industrial revolution to take place. Secondly, they should equip themselves with suitably designed distribution and reporting platforms and tools that will allow them to engage ex-ante and ex-post in a meaningful dialogue with asset owners, a dialogue centered around time-varying probabilities to achieve investors' goals.[1]

In the profound soul-searching process that is currently under way in investment management, I believe it is important for all parties involved to maintain a proper perspective and see what is happening as what it actually is, namely a unique opportunity for our industry to add value for society as a whole. Incidentally, asset and wealth managers willing and able to embrace this challenge will be able to grow a profitable business as they will start to more properly address the needs of their clients.

Note

[1] Technically this requires the use of Monte-Carlo simulations under the risk-neutral probability measure. This rather requires Monte-Carlo simulations under the historical probability measure, with a change in measure from historical to risk-neutral that involves risk premium estimates.

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References

Amenc, A., Deguest, R., Goltz, F., Lodh, A., and Martellini, L. (2014). *Risk Allocation*, *Factor Investing and Smart Beta*: *Reconciling Innovations in Equity Portfolio Construction*. EDHEC-Risk Institute Publication.

Amenc, A., Goltz, F., Lodh, A., and Martellini, L. (2012). "Diversifying the Diversifiers and Tracking the Tracking Errors: Outperforming Cap-Weighted Indices with Limited Risk of Underperformance," *Journal of Portfolio Management* **38**(3), 72–88.

Ang, A., Goetzmann, W., and Schaefer, S. (2009). "Evaluation of Active Management of the Norwegian Government Pension Fund Global," Available at http://www.regjeringen.no.

Ang, A. (2014). *Asset Management*: *A Systematic Approach to Factor Investing*. Oxford University Press.

As an example of this evolution, the number of Fortune 500 companies offering traditional DB plans to new hires fell from 51% in 1998 to 7% in 2013 (Retirement in Transition for the Fortune 500: 1998 to 2013, Insider Report, September 2014, Towers Watson, available at https://www.towerswatson.com/en/Insights/Newsletters/Americas/Insider/2014/retirement-in-transition-for-the-fortune-500-1998-to-2013).

Badaoui, S., Deguest, R., Martellini, L., and Milhau, V. (2014). *Dynamic Liability-Driven Investing Strategies*: *The Emergence of a New Investment Paradigm for Pension Funds?* EDHEC-Risk Publication.

Bodie, Z., Fullmer, R., and Treussard, J. (2010). "Unsafe at Any Speed? The Designed-in Risks of Target-Date Glide Paths," *Journal of Financial Planning*, March 2010.

Chhabra, A. (2005). "Beyond Markowitz: A Comprehensive Wealth Allocation Framework for Individual Investors," *The Journal of Wealth Management* **7**(5), 8–34.

Cox, J. and Huang, C.-F. (1989). "Optimal Consumption and Portfolio Policies When Asset Prices Follow a Diffusion Process," *Journal of Economic Theory* **49**, 33–83.

Das, S., Markowitz, H., Scheid, J., and Statman, M. (2010). "Portfolio Optimization with Mental Accounts," *Journal of Financial and Quantitative Analysis* **45**(2), 311–334.

Deguest, R., Martellini, L., Suri, A., Milhau, V., and Wang, H. (2015). *Introducing a Comprehensive Investment Framework for Goals-Based Wealth Management*. EDHEC-Risk Publication.

Duffie, D. (2001). *Dynamic Asset Pricing Theory*, Third Edition. Princeton: Princeton University Press.

Fabozzi, F., Martellini, L., and Mulvey, J. (2014). "Proper Valuation Rules for Pension Liabilities," *Investment and Pension Europe*, *EDHEC-Risk Institute Research Insights* Winter 2014, 4–5.

Fernandes, D., Lynch, Jr., J. G., and Netemeyer, R. G. (2014). "Financial Literacy, Financial Education, and Downstream Financial Behaviors," *Management Science* **60**(8), 1861–1883.

Karatzas, I., Lehoczky, J. P., and Shreve, S. E. (1987). "Optimal Portfolio and Consumption Decisions for a Small Investor on a Finite Horizon," *SIAM Journal of Control Optimization* **25**, 1557–1586.

Lopes, L. (1987). "Between Hope and Fear: The Psychology of Risk," *Advances in Experimental Social Psychology* **20**, 255–295.

Martellini, L. (2006). "The Theory of Liability Driven Investments," *Life & Pensions Magazine* **2**(5), 39–44.

Martellini, L. and Milhau, V. (2015). "Mass Customization Versus Mass Production in Retirement Investment Management: Addressing a "Tough Engineering Problem," Working Paper, EDHEC-Risk Institute.

Martellini, L. and Milhau, V. (2015). Factor Investing: A Welfare Improving New Investment Paradigm or Yet Another Marketing Fad?

Merton, R. C. (1971). "Optimum Consumption and Portfolio Rules in a Continuous-Time Model," *Journal of Economic Theory* **3**(4), 373–413.

Merton, R. (2003). "Thoughts on the Future: Theory and Practice in Investment Management, "*Financial Analysts' Journal* Jan./Feb., 17–23.

Merton, R. and Bodie, Z. (1995). "A Conceptual Framework for Analyzing the Financial Environment," in *The Global Financial System—A Functional Perspective*. Harvard Business School Press.

Shefrin, H. and Statman, M. (2000). "Behavioral Portfolio Theory," *Journal of Financial and Quantitative Analysis* **35**, 127–151.

Technically this requires the use of Monte-Carlo simulations under the *risk-neutral* probability measure.

This condition can be regarded as a necessary and sufficient condition for ensuring the protection of essential goals with probability 1.

This rather requires Monte-Carlo simulations under the *historical* probability measure, with a change in measure from historical to risk-neutral that involves risk premium estimates.

Tobin, J. (1958). "Liquidity Preferences as Behavior Towards Risk," *Review of Economic Studies* **25**, 65–86.

van Binsbergen, J., Brandt, M., and Koijen, R. (2008). "Optimal Decentralized Portfolio Management," *Journal of Finance* **63**(4), 1849–1895.

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