A SMART Approach to Portfolio Management
An Innovative Paradigm for Managing Risk

ARUN MURALIDHAR
2008 was a watershed year as dramatic market movements exposed the flaws in the theory and practice of pension fund management. Solvency declined dramatically, hedge funds did not deliver, rebalancing policies detracted value and liquidity dried up tainting the allure of “alternative” investments. Static policies for dynamic markets are undoubtedly flawed and have to be changed with the support of appropriate liquid, transparent and low cost benchmarks; implicit bets need to be made explicit and managed; naïve performance measures have to be improved; and the CAPM needs to be revamped dramatically. But this process can only start with investors taking the time to understand how various market factors influence assets or managers and then develop a set of rules so that as the factors evolve over time, the optimal portfolio evolves simultaneously. SMART (Systematic Management of Assets using a Rules-based Technique) management of assets and liabilities leads to improved solvency and a lowering of ALM risks. SMART is about introducing good process – namely, only measured and monitored risks can be managed. This book presents a new design for pension fund management that allows CIOs to be smart about managing assets relative to liabilities and, at the same time, allows them to access alpha flexibly (and compensate managers only when they demonstrate skill), thereby improving solvency.

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Preface

"Not only it's not right, it's not even wrong.” Wolfgang Ernst Pauli

My friend Joe Azelby has a great story about how when you go deep-sea fishing you want a captain who is missing one eye, a few fingers, possibly a ear, among other infirmities. You know your crew members are going to make mistakes, so you prefer someone who has already made the full quota of mistakes on previous trips!

After making a series of ‘mistakes’ at the World Bank, J.P. Morgan Investment Management, FX Concepts, and my own companies, I felt it worth documenting “what not to do” so that others could learn from my bad decisions. However, such a tone is never helpful, so I decided to offer a more positive, time-tested approach to managing assets –how to be a “SMART” investor! My previous book (Muralidhar 2001) had boldly proclaimed an offer of innovative approaches to plan sponsors but, on further introspection, though many of the concepts presented have proved useful, there were also many prescriptions that had fallen short. Fortunately, my brother, Sanjay, urged me to stop writing about how to

1 www.wikipedia.com
manage assets and turn my attention to actually helping plan sponsors make effective decisions to measure, monitor, and manage their risks.

The call for this book is quite clear – (i) the investment industry has fixated on static prescriptions for long-term strategic asset allocations (SAAs) and naïve rebalancing; (ii) the literature on liability driven investing (LDI) and portable alpha is biased by asset managers trying to sell products rather than solve sponsors’ problems; (iii) performance measures that do not incorporate risks or skill are problematic, as are the compensation schemes that serve the asset manager more than the pension plan; and (iv) most important, the anchor of financial theory – the capital asset pricing model (CAPM) – has ignored the entire class of pension fund (or institutional) investors who delegated decisions to others as also the impact of their behavior on markets. In short, static policies for dynamic markets are undoubtedly flawed; naïve performance measures have to be improved; and the CAPM needs to be re-examined.

Fortunately, we had tried to dis-intermediate asset managers. As far back as 2002, my colleagues and I developed software to allow investors to create the same state-of-the-art investment procedures they demanded from their asset managers. We developed case studies for clients in 2004-2005 to show how rebalancing could be improved from an asset-only perspective, how dynamic LDI strategies are superior to simple duration extension, and how manager allocation management is preferable to focusing on manager selection alone. As part of our marketing effort, we published extensively in trade journals and, fortunately, creative pension funds that were resource-constrained forced us to put our
money where our mouth is and had us working for them on a largely performance fee basis... and then came 2008!

Bogle (2009) highlights the dramatic impact of market movements on the U.S. pension fund industry, but one can easily extrapolate from this to apply to other markets as well. “Assets of corporate pension plans have declined from $2.1 trillion as far back as 1999 to an estimated $1.9 trillion as 2009 began...pension plan assets to cover future payments to retirees have tumbled from a surplus of some $270 billion in 1999 to a deficit of $376 billion at the end of 2008. Largely because of the stock market’s sharp decline, assets of state and local plans also tumbled, from a high of $3.3 trillion early in 2007 to an estimated $2.5 trillion last year.”² The impact on defined contribution (DC) plans has also been severe, as “[t]he growth in DC plans has been remarkable. Assets totaled $500 billion in 1985; $1 trillion in 1991; $4.5 trillion in 2007. With the market crash, assets are now estimated at $3.5 trillion...IRA assets presently total about $3.2 trillion, down from $4.7 trillion in 2007.”³

Whether by luck or skill (and we provide an equation in Chapter 2 to judge this), our models - applied by our pension plan clients and ourselves - have delivered positive performance relative to all other naïve rebalancing approaches, they have improved solvency (if they had been implemented) relative to other approaches, and have lowered absolute risk or drawdowns, whether measured on an asset-liability or an asset-only basis. Many academics and practitioners have

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² Page 4.
³ Page 5.
been calling for dynamic strategies\textsuperscript{4} since the 1980s, and we present a simple route for plan sponsors in defined benefit (DB) plans and participants in DC plans to achieve their goals without paying excessive manager fees.

This book is organized as follows: Chapter 1 provides a different perspective on the Chief Investment Officer’s (CIO’s) role (reflecting, in part, my own frustrations of being more an auditor than an investor when I was a plan sponsor). Chapter 2 discusses a new approach to the CAPM and emphasizes the need for a new dynamic finance theory, which incorporates the actions of CIOs and their interactions with Boards and asset managers. Chapter 3 argues for a clearer articulation of investment goals (with a focus on solvency rather than strictly asset performance), the need to risk and skill-adjust performance and ideas for ensuring the creation of simple, effective, and easy-to-implement liability and asset benchmarks. This chapter is critical, as earlier benchmarks have been costly and inefficient to replicate, thereby unnecessarily detracting from performance and the ability to be nimble. Chapter 4, the lynchpin of this book, provides the case for the SMART (Systematic Management of Assets using a Rules-based Technique) approach and is an expose\textsuperscript{'} of some of the more voluble, if misguided, institutional investors. Chapter 5 moves on to actual portfolio management, demonstrates the failure of typical SAA policies, and argues for SMART View Neutral SAAs – earlier advocated in Muralidhar (2001). Chapter 6 takes it up a notch and demonstrates how SMART View Based portfolio management is essential – especially given the assumption on correlations in the primary asset allocation studies. Chapter 7 moves on to a study of the implication of

\textsuperscript{4} Barrett (2006); Brock (2005); Hodgson (2006); Mulvey (1988); Mulvey (1994); Arikawa et al (2005); Muralidhar (2007); and Muralidhar and Muralidhar (2009).
emphasizing skill in manager analyses and discusses its importance in risk budgeting – demonstrating that two tracking errors of 3 percent are not the same from a confidence-in-skill perspective – and, more important, proposes a totally new compensation method for asset managers which underscores risk and skill adjustment. Chapter 8 brings the discussion full circle to show how dynamic management of liabilities, beta, and alpha (i.e., external managers) can improve solvency. Chapter 9 is a mild digression into the area of DC investing, as we find the current offering of Target Date funds (TDFs) to be a potentially deceptive manipulation of the investing public – sadly, maneuvered in part by the Department of Labor’s (DoL) unintended regulation.

Ultimately, the impetus for this book was a review from the Financial Analyst Journal (FAJ), supported by the Editor, on a paper that I wrote to summarize all these concepts. It read, “[T]his piece is quite commercial, and in addition presents many conclusions without thoughtful demonstration and derivation. While interesting, it is better published as a house publication rather than by a refereed publication.

It is descriptive of an approach, but without theoretical justification. And yes, it does get much right but for lack of good theory also gets some important things wrong. I have to admit that approach to beta, a "beta engine," is pretty far out there. And so-called "rule" that a pension's equity allocation could be something like "20% + 0.4 *Funded Status" is just wrong -- and unsupported.”
In summary, we have used the vast experience of our clients and friends in North America, Europe (mainly the Netherlands), and Japan to develop a case study approach which is more enduring, as it demonstrates how the same principles can be applied in many different situations. In addition to the vitriolic review from the FAJ, many others are likely to attack this approach, given the belief that “market timing” is untenable. But the fact is that the minute a decision is made on a portfolio – even in setting up an SAA – we are market timers and the most meaningful market timers are the asset-liability management (ALM) consultants (who often do not help pension funds understand and manage these long term bets). So rather than attach labels to what we do, we are keen to see CIOs adopt good processes to ensure the effective delivery of pensions promised to their members, well within the risks permitted and at the lowest possible cost.

To be explicit, this is not to advertise my firms. But what goes against the grain is that the individual who critiqued the paper was fundamentally a fiduciary and responsible for advising many pension funds and the review was more naïve than my paper. Hopefully, the techniques explained here can be used by CIOs without depending on asset managers, consultants, and their ilk, thereby saving significant costs and, hopefully, further improving solvency and governance.

DISCLAIMER
The views expressed in this book are my personal views and not that of any organization I have worked for in the past or currently work for. I take full responsibility for all mistakes and absolve my many co-authors of any errors.
Acknowledgments

“I stand by all the misstatements.” Dan Quayle

Acknowledgments are dangerous in that one runs the risk of ignoring someone who was critical to the process of writing. Therefore, I proceed with some trepidation.

I have been blessed with mentors like the late Prof. Franco Modigliani whose constant expectations of the best professional work and a social conscience have shaped my thinking, life, and writing. His spirit lives on in the work of his students.

I have also been fortunate to be able to lean on friends like Lester Seigel, who took a call from me in 1997 when I jumped out of the shower to tell him why the CAPM was wrong (Chapter 2); Patrick Groenendijk, for seeing the potential in our idea of dynamic management when even we did not see it; Eric Busay, who started as a client and has become a dear friend; Charlie Ruffel, who took pity on a lost soul and offered sage advice and some hope; Roland van den Brink, for being the first one to jump on board, for sharing his vision of a CIO dashboard, and for his brilliant ideas written on numerous napkins and table covers; Karin

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5 Petras (2001), page 25. Then vice-presidential candidate, Dan Quayle, defending himself against criticism for making verbal gaffes.
Brodbeck, for giving us our first break to manage assets on this basis, her attention to detail and willingness to innovate; Roger Paschke, for always being willing to push the envelope – our overlay on an overlay using options required vision and innovation beyond the ordinary; Harish Neelakandan, for his humor and smarts to create the overlay on the overlay using options – this was brilliant but, sadly, under-appreciated; Ken Lay, for showing me very early in my career how to fight for what is right; Hideo Kondo, for teaching me how to run a plan with one staff and still be phenomenally innovative; Khaled Balama, for believing in what we were doing in a difficult environment and for his friendship; Kirit Patel, for being who he is – a wise man with a small ego; Mark Schmid, for giving me the time of day when he had more important things to worry about; Andrew T. Ward for his constant support; Masataka Hama, Koichi Shijima, and Masayuki Azuma, for getting the point of the software and the need for SMART rebalancing when few others in Japan saw the potential; Bradley Leak and Tim Barrett, for showing me that rebalancing ranges are counter-productive when you are smart; Donald Pierce, for taking our work to a new level and his good restaurant selection; James Perry, for his happy outlook on life and sage advice; Pieter de Vries Robbe’, for fighting all odds to give us a chance; Hein Brans, for persevering with us even when he did not have the resources; Joseph Silveira, for spending weekends trying to help us improve our work; David Deutsch, for his sustained support and innovative idea about a Beta Engine; Lisa Needle, for urging us to up our game and backing us against all odds; K.C. Howell, for paying us even when I did not add the value I promised; Larry Kochard, for his comment about dis-intermediating the asset management business; Paul Fahey, for taking the pains to show how this worked in Canada; Tom Zuchosky, for being the first fund-of-funds manager to
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I have to thank my buddy Rohan for showing me that even an 18 year old could grasp the nuances of this industry in just one month! Finally, thanks to my wife Shaila and my kids Sidharth and Sachin for giving me the time to do this. Shaila is learning slowly that Serena Modigliani was not kidding when she told Shaila that the experience of living with me would only get worse with time...and still she sticks by me. Thanks to Jeanette Fernandes for an amazing job of editing this at short notice.

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I dedicate this book to Mrs. Turner and Mrs. Rhatigan of Maurice Hawk Elementary School in West Windsor, NJ, for teaching my first and third graders to write books at this tender age (including how to write an index and glossary!), and to my mom (Minakshi Muralidhar) and Shaila’s mom for encouraging their kids too to write.
The New Paradigm for CIOs – Doing More with Less

Mohammed Ali had boarded a plane one day and just before take-off, was requested by a stewardess, “Sir, please fasten your seat-belt.” The youthful, exuberant Mohammed Ali is believed to have remarked, “Superman does not need a seat-belt....” to which the smart young lady replied, “And Superman does not need a plane either!”

ROLE OF THE CHIEF INVESTMENT OFFICER

The volatility of the markets in 2008 created turbulence in finance portfolios not envisaged by even the most astute investors. Only those who had their seat-belts in place have emerged from the debacle relatively unscathed. However, this unanticipated crisis may be put to good use as a lesson for the institutional investment management industry. It has served to expose the failings of previous research, regulation, and advice on the investment of institutional assets. Bearing in mind the counsel of Rahm Emanuel, President Obama’s Chief of Staff, “Never let a crisis go to waste,” this book uses the lessons of the 2008 harsh reality-check to help CIOs do much more with less, since budgets having been drastically cut. Equally important, this book reveals the drawbacks in the current practices of managing assets and rewarding asset managers. CalPERS, typically a
leader in investor activism, has proclaimed that fees of hedge fund managers are
in need of review, and it appears likely that other pension funds will join in this
chorus. Fortunately (and unfortunately), the recent market turmoil has also
exposed the impact of corrupt middlemen on fees and manager selection.
It is therefore pertinent to focus on an entirely new paradigm for managing assets
– one focused on dynamism of decisions, which is vital in an environment driven
by dynamic market performance. In so doing, this book expunges the old
paradigm, professed by asset managers and many consultants, where hiring an
external manager with all the fee issues it entails to perform a given task (e.g.,
manage portable alpha or LDI) was presented as a silver bullet requiring no
further action.
Sadly, the CIO’s role during the tension of 2008 has been one of firefighter – often
having to bear bad news of failed hedge funds, securities lending, or even illiquid
cash investments, CIOs had to make frantic attempts to raise cash to meet
outstanding obligations, as the failure of alternative investments and seemingly
safe assets exposed chinks in the armor of even the Ivy League endowments.
Moreover, many CIOs have paid the price for choosing to be innovative: Boards
have been forced to fire CIOs when their funds lost 20-30 percent of their value in
a single year, in response to a cry for blood! Many times, the call to dismiss a CIO
came from a misinformed local press or public that picked on a single bad
decision and a supposedly outsized pay package. Such distress could have been
easily averted if the task had been set up efficiently, expectations discerned and
fulfilled with care, and performance and risk-adjusted performance adequately
monitored.
Roland van den Brink, CIO of Bedrijfstakpensioenfonds Metaelektro in the Netherlands (PME) and currently Executive Director of Mn Services, ran one of the most effective pension funds in the world. He entrusted only three key investment staffers with the management of assets in excess of Euro 20 billion, and liberally outsourced activities that were best performed on a mass scale by outsiders. This clear division of labor controlled costs and probably minimized staff management time. More importantly, he likened himself to the pilot of a plane and monitored his plan in a similar fashion. He organized his plan data in a simple, succinct pension dashboard, which kept him constantly updated on where his fund was headed relative to liabilities, the risks being taken, and the direction needed to proceed to ensure continued solvency. His motivation probably came from the belief that “once you manage risks, you can then focus on returns.”

Philip Menco of de Eendragt (and one-time colleague of Roland), who shares the same philosophy, turned in positive performance for the economically-floundering year of 2008 through effective, high-level investment strategies.

The CIO’s role in the new millennium has new challenges. Solvency has declined, budgets have been cut, and the complexity of managing assets has increased, with less transparency, less liquidity, and less bargaining power on the part of investors. However, it is incumbent on the CIO in this new environment to re-establish the Board’s objectives and risk tolerance as well as its investment horizon. The CIO must re-structure the entire investment paradigm to evaluate those investments that best achieve the objectives of efficacy, liquidity, transparency, and low cost. The Chinese proverb that states, “One cannot be a genius in one’s own village” applies most often to CIOs at public institutions. There is a general presumption that outside managers are smarter than internal
staff. Hence, the pointer here is that the Board would be well served to rely more on their own CIOs (once the appropriate governance and monitoring structure is set up) and less on external advisors.

Effective real estate decisions are driven by “Location, Location, and Location.” Similarly, the SMART (Systematic Management of Assets using a Rules-based Technique) paradigm is based on “Allocation, Allocation, and Allocation.” The three key areas where these allocation decisions will be emphasized are: (i) Allocation to a Liability Hedge; (ii) Allocation to Beta Assets; and (iii) Allocation to Alpha Opportunities. The SMART process attempts to bring best practices (adopted by asset managers) into the suite of capabilities of pension assets because the potential benefit from adding a few basis points to the total portfolio is likely to be more valuable than finding the best managers. SMART also has the advantage of better decision-making (not subject to emotion), transparency, consistency, governance, and risk management.

THE NEW SMART LDI APPROACH – LIABILITIES, BETA, ASSETS, AND COSTS

The recent financial market meltdown has impacted pension funds (and other investors) world-wide, imperiling their financial status too. There have been dramatic declines in solvency or size of portfolios even in the Netherlands, where the focus on ALM is both extensive and impressive, and the regulation of pension funds by the Dutch Central Bank (DnB) is based on funding rather than asset performance. In many cases, solvency dropped from 140 percent to 90 percent, and even the DnB’s own pension fund had fallen below 100 percent solvency.⁶

Regulators in the Netherlands, the UK, and the United States are being pressured into adopting conciliatory measures, including avoiding onerous recovery plans, relaxing mark-to-market accounting, allowing flexible asset smoothing and extending recovery periods. For example, in the Netherlands, current regulations require pension funds to return to 105 percent solvency in three years (regulators are being pressured to raise the term to five years), which would entail a drastic cut in pensions, an increase in contributions, or more risk-taking – all unpleasant measures in the current environment. Though this book focuses on pension funds, many of the same principles are applicable to endowments/foundations, sovereign wealth funds (SWFs), social security (SS) funds, insurance companies, and retiree health care plans as well.

Two trends have taken hold of the markets in recent months, among the slew of innovations in the management of pension funds and other assets. First, the “LDI” trend, with a clearer recognition of the need to tie assets to liabilities, is gaining attention after 2008. The adoption rate has been slow because of changing regulation. The goal of the standard approach is strictly to increase the correlation between assets and liabilities; but this is just one part of the equation – the returns need to be matched as well. The second is a separation of two different sets of contributors to returns and the management thereof – called

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9 Thanks to Patrick Groenendijk of Vervoer Pension Fund for this insight.
“Separating Alpha and Beta.” This book will demonstrate that these two trends are not separate, but rather can be implemented effectively in one superior approach, especially if clients use SMART. In short, CIOs can improve performance and solvency by being smart about the regular cash flow and rebalancing decisions that they habitually make on alpha and beta assets. This is different from the current approach where the spotlight is on manager selection (or static alpha) and a naïve extension in duration, as opposed to managing beta and managing manager allocations against an effective and easily tracked liability benchmark.

For simplicity, this book separates the portfolio management discussion into three segments – i) Liabilities, ii) the Beta Engine, and the iii) Alpha Engine - and briefly contrasts current practice with the more innovative approach. In a recent study of 153 U.S. pension plans, of which 43 percent had assets under management in excess of U.S. $1 billion, MetLife (2009) highlights that “Asset Allocation” was selected 54 percent of the time as the risk factor to which plan

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10 A good example of bad advice by asset managers seeking to sell products rather than help investors make effective decisions is Callin (2008). We will invalidate the arguments offered in Callin (2008) in an attempt to help investors get a clearer understanding of the true risks and how they must manage them. Another appalling recommendation is Robert Arnott (2009), also under the PIMCO umbrella, to pitch 20-year bonds as a long-term substitute to equities based on point-of-time statistics.

11 For example, the DIC Pension Fund in Japan thinks very creatively about hedging liability risk and private equity beta risk. While this book borrows many ideas from innovative CIOs such as Mr. Hideo Kondo, it attempts to promote a much broader perspective than just return generation or hedging.

12 We are grateful to David Deutsch and Lisa Needle, former CIO and Acting CIO, respectively, of the San Diego County Employees Retirement Association for allowing us to use these terms which they have utilized in the effective implementation of their fund.
sponsors pay most attention;\textsuperscript{13} “Underfunding of Liabilities” was selected 47 percent of the time;\textsuperscript{14} and “Asset and Liability Mismatch” was selected 43 percent of the time.\textsuperscript{15} This warrants our focus on liabilities, beta management, and good process, as over 57 percent of respondents agreed that, in their experience, there is evidence of limited or no holistic risk management.

Regrettably, costs have been neglected in the last few years as investment vehicles became more and more sexy. A reduction in costs is a straight improvement in performance, and Chapter 9 shows how this can help individual investors dramatically. CIOs can set up their overall SAA at extremely low cost, and ensure that staff and managers are paid commensurate to not only the risks they take but also to the skill they display.

Make no mistake – this is not equivalent to jumping on the Washington DC bandwagon to restrict executive pay. Quite the opposite –hefty bonuses should be made to the most talented investors, with the caveat of ensuring that their performance is based on appropriate risk management and a clear demonstration of skill. The approach highlighted in Chapters 7 and 9 turns a common argument made by asset managers on its head – namely, that CIOs and Boards were accused of being too short term in their evaluation of products. This argument is reversed to compel asset managers to be long term as well, and to defer payment

\textsuperscript{13} The question was positioned as: we use disciplined rebalancing to implement a documented strategic asset allocation policy.

\textsuperscript{14} The question was positioned as: The design and execution of our investment strategies have proven effective in comfortably managing our funding contribution level.

\textsuperscript{15} The question was positioned as: We carry out regular studies that have proven accurate and effective in managing mismatches between the duration of plan assets and liabilities.
for the performance component of their fees to later in the product cycle, once skill has been established.

As an aside, nowhere is such an approach as essential as in the DC space where retail investors are made to sacrifice today for the promise of a rosy future with products such as “Target Date Funds.” Pogue and Modigliani (1973, 1975) argued for the reform of mutual fund fees that appropriately adjusted for risk, but the lack of progress in this positive direction demonstrates the clout of the product provider and less than optimal regulation by Washington DC. To avert a pension crisis in the retail investment space, such re-evaluation in compensation to mutual fund managers may have to be mandated by regulation, as individual investors lack the bargaining power of the pension fund CIOs – the likely audience for this book.

**CHALLENGES – CASH FLOWS/ REBALANCING, DYNAMIC DECISION-MAKING**

In the late 1990s, I was engaged in helping to manage the World Bank’s pension fund. We were blessed with staff, technology, budget, and talent a-plenty, but the bulk of the work befitted an auditor rather than an investor. Even though our team managed one of the more sophisticated global pension funds under the leadership of Afsaneh Beschloss (with many innovative approaches – now defunct – highlighted in Muralidhar 2001), our conduct was not of hard-core investors, as too much time was spent meeting managers and on ALM studies and too little time on being effective investment managers. When I left the World Bank to join JP Morgan Investment Management (JPMIM), I received an automatic pay
increase – paid for by the pension funds I served. And I immediately felt I should be paid more – the instantaneous injection of arrogance that infects us when we move to asset management from pension management. However, the most impressive aspect of my new job was not the brilliance of the work but rather that the process for making all investment decisions was very clearly articulated. I attributed this emphasis on process to the miserable drill of having to fill out Requests for Proposals (RFP) designed by the same pension fund CIOs this book targets. Fill out enough RFPs and the investment process becomes religion. Equally important to large asset managers was that, while performance was variable and questionable at best, process allowed for a consistent approach, immunity against staff departures (my own term with JP Morgan was brief and my departure not missed!), and the ability for global information sharing. Every morning, a little sheet specifying the day’s recommended transactions would be made available. Given the data released as of the night before (economic, price, sentiment, value, etc.), for every portfolio under management, the all-important sheet would highlight:

(i) **What** actions need to be taken – buy/sell/do nothing;
(ii) **How much** was to be taken – 1 percent, 0.5 percent;
(iii) **When** it had to be done – at the open of London markets though some managers (FX Concepts) had strict time-based recommendations; and
(iv) **Why** did these actions make sense – focusing on the specific change in momentum or economic data that caused a re-evaluation of the recommendations.
The most critical aspect of this approach was an explicit recognition that not doing anything was also a bet – something most pension funds have not realized, though investment policies suggested by consultants and implemented by pension funds are replete with them. Our practice was to spend a few minutes as a team reflecting on the systematic recommendations of our models, give portfolio managers the discretion to add to or subtract from the positions – based on their views on the market which might not have been captured in the systematic process (e.g., politics) – and then implement the final recommendation, tracking in detail, the ensuing performance and risks.

In the simplest terms, to become an effective Pension Pilot à la Roland van den Brink, every implicit decision in a pension fund needs to be made explicit – after all, only what gets “M” easured and “M” onitored gets “M” anaged: the “M³ of Investing.” A pension fund CIO has the exact same job of managing assets as do the external managers they hire – only the asset labels are different. Therefore, SMART pension fund CIOs should put themselves through the same RFP questions they ask of their external managers, namely:

1. What are the key areas on which to focus daily decision-making?
   a. Liability Hedge, Beta Allocation, Manager Allocations (as these are the typical elements of a pension fund).

2. What is the decision on these identified areas today?

3. What is the basis of this decision?
   a. Qualitative judgment (perfectly acceptable) or a systematic process;
   b. If systematic, what factors are used to make the daily recommendation?
4. Which staff member is responsible for which decision?
   a. CIO for liability hedge and rebalancing/currency management;
   b. Staff for external manager allocations

5. How is consistency in decision-making ensured, and what is the process for reviewing whether these decisions have been effective and for changing them if they have not?

Danny Ozark, manager of the Philadelphia Phillies sports team, is credited with the amusing observation, “Half this game is 90 percent mental.” His humorous words come to mind when this book argues that half the time, good investing is 95 percent process and 5 percent good ideas. At the end of the day, investing is not rocket science but effective application of economic intuition to a set of decisions. At the World Bank I would rush to my Bloomberg terminal in the morning, soak up the news chatter (which today is a 24/7 product on multiple channels), and then, when we would congregate to argue incessantly, before rendering a decision, without sufficient clarity on who owned the final decision or how we ensured consistency in this decision-making – the danger of having “too many chiefs and not enough Indians.”

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16 The two simplest implicit bets in investment policy are the choice of strategic currency hedge as that is a bet on the local currency; and the rebalancing policy, which suggests doing nothing when the portfolio drifts between the rebalancing policy ranges. We return to these topics in Chapter 4.
Many of us old-style investors were shocked with the dramatic and sudden move to alternatives, including private equity, hedge funds, and more exotic investments. In large part, this embodied a drift to the “endowment” model, which became the mantra of Ivy League CIOs who were elevated to Buddha-like status. Their every move was emulated without anyone pausing to ask the basic question: “Is it worth taking such a costly, illiquid bet?” (In other words, “What is the cost of illiquidity and lock-ups, and when will it hurt me the most?”). The balance of power had shifted so dramatically towards asset managers that even the CIOs of the largest funds had little say in the terms and restrictions of these alternative investments.

In 1995, we were asked by our consultant to review a private equity deal at the World Bank (the consultant got paid on commitments rather than disbursed amounts!). Surprisingly, the list of co-Limited Partners (LPs) was the same from previous deals - names that any asset manager would die for! However, the document was designed by the General Partner (GP), with terms most favorable to the GP, with little recourse to the most sophisticated global pension funds. So why didn’t the LPs band together and dictate terms to the GP rather than willingly submit to self-flagellation, that too for an investment where the ability to gauge future success was as meager as “Trust Me”? Years later, the same drivel would be perpetuated by “hedge funds” and fund-of-funds (FoFs) to the detriment of the investor.

Maybe it’s time to return to basics and ask whether the goals of managing a pension fund can be met through effective, low-cost, transparent, liquid, dynamic
management of beta and liabilities. If so, forget about alternatives or, at the most, play with them at the margin to extract any ‘alpha’ from illiquidity, but recognize that gates, lock-ups, provisions on selling partnership interests in secondary markets, and restrictions on revealing the nature of the investment (especially in private equity) are effectively a straight increase in the cost of the investment, and hence a lower after-fee performance.\textsuperscript{17, 18}

The simple prescription proposed is for CIOs to follow the low cost, high value-added KISS principle: “Keep it SMART and Simple.”

**RISK MEASUREMENT NOT EQUAL TO RISK MANAGEMENT**

Risk Management, a one-time fad, is lamentably a misnomer in our industry today. A major U.S. pension plan spent millions purchasing an expensive risk system, and spent an additional set of millions to pay consultants to implement the system, only to have their senior investment officers ignore the risk report – so much so that when the frequency of distribution of the report dropped from daily, to weekly, and then monthly, there was no protest from the staff members it was supposed to serve.

People often confuse Risk Measurement with Risk Management. The latter is the responsibility of the CIO and investment staff, and is accomplished by making effective decisions on every allocation or selection decision in the fund. Risk Measurement, on the other hand, is what outside vendors offer at high cost for little value! Roland’s Pension Dashboard focused on daily risk measurement (i.e.,

\begin{footnotesize}
\textsuperscript{17} Muralidhar and van der Wouden (1999).
\textsuperscript{18} It surprises us that consultants and FoFs did not price out the various options that pension clients sold for “free” to asset managers, and that these options were exercised at the worst possible time for the investor.
\end{footnotesize}
value-at-risk, black swan risk), but he, as CIO, focused on Risk Management. I recall the Treasurer of the World Bank in 1997, Gary Perlin, asked us how much we would lose if emerging markets collapsed. Since we had already implemented, what was probably the first LDI-based pension risk system at the time, we ran the numbers and gave him an estimate. When markets did collapse the following year, I went back to Gary to proudly show him how smart we had been: our models were within a tad of the 1997 estimate. To which Gary promptly replied in his soft and extremely polite tone, “If you were so damn smart, why didn’t you make me money?” Never again did I confuse Risk Management with Risk Measurement.

**STAFFING AND COMPENSATION**

Another interesting aspect of institutional asset management is the willingness of the pension fund Boards to pay external managers many times more than what they could pay internal staff for equivalent, if not better, decisions and greater control. My own pay increase was evidence of this! Yet, it is common to have many CIOs pilloried in the press for high salaries, only to have the Fund hire an external asset manager for higher multiples than that ‘disputed amount’. Paying Wall Street high salaries is not the fault of Wall Street, but the fault of Main Street. This is an industry that has no pre-qualifying certification for becoming an investor – in fact, most of my bosses never had CFAs or even a finance background, yet did exceedingly well. More important, every investor at an asset management firm has learned their craft at the expense of the end client; so maybe it is time for pension fund Boards and CFOs to see the fund as a potential profit center and allocate resources appropriately. For example, on a $1
billion fund, a 2 bps enhancement by improving rebalancing is equivalent to $200,000 – something worth paying for.

Every organization has to decide where they have the greatest competitive edge, and hire staff accordingly. One may argue, as manager research is a generic activity with publicly available data, an effective small-sized pension fund may want to have a CIO focus on Liabilities and Beta Management, delegating to one or two staff member/s the job of selection and the management of allocation to alpha managers. The actual data collection and due diligence are outsourced to an industry (consultants) that has grown for this purpose and where this data has become a commodity – hence the low cost for smaller funds. If the Dutch had adopted this model in their drive to improve governance and solvency and to lower costs, they may not have ended up allocating assets to foreign fund managers with little-to-no background in managing Dutch pension assets and firing many CIOs who were exceptionally well qualified. Some of the blame for this trend lies at the door of the DnB, which decided to apply onerous reporting/model restrictions and then worried about the outsourcing of Dutch assets to foreign, potentially poorly qualified (regardless of brand name) asset managers.

In a revision from our recommendation in Muralidhar (2001), this book now urges a better relationship between Boards and staff, based on appropriate, long-term compensation structures, thereby eliminating the need for “Advisory Boards,” which had earlier (mistakenly) been suggested to help CIOs garner support for their innovative ideas. Smart Boards should entrust their staff with clear mandates and allow them to innovate instead of wasting time and effort building consensus. Moreover, while a group of quantitative analysts were suggested to
carry out performance attribution and risk assessment, these tasks are easily outsourced at low cost to custodians or consultants who collect the requisite data – though they may need to be prodded by CIOs to deliver exactly what is needed instead of what the custodian would like to present.

The SMART paradigm requires no more than a CIO and a deputy-CIO who can focus solely on liability, beta and currency management (and manage the Board and internal staff), and the appropriate number of staff to oversee external managers, with the CIO ultimately responsible for pulling together all the operations and ensuring that risks and returns are appropriately diversified. It is no surprise then that the case studies presented here are from clients who have run a meaningful size of assets with limited staff and have yet managed to raise the bar in pension investing.

THE PENSION DASHBOARD

Each client is different, but some basic information at the start of every business day is a prerequisite for an effective pilot/CIO. A disciplined pilot needs to i) ensure that all systems are in good working order; ii) to be clear about where their final destination is; and, iii) based on factors such as weather and traffic, whether it is most expedient to travel in a straight line or make appropriate deviations to arrive at the destination on schedule and in the safest possible manner.

The Pension Dashboard displays, on a quantitative and qualitative basis, the following information in a single table:

1. Performance on an absolute, relative, and risk-adjusted basis year-to-date and since inception, given the previous night’s data.
Such information on the current situation of the fund helps to determine whether to increase/decrease risk going forward.

2. The key decisions to which performance is attributed.

3. The current liability hedge, and the action needed to be taken to change it.

4. Current asset allocation including currency, and whether it is the correct one for the present market environment.

5. Which asset classes are impacted, if changes are suggested, the magnitude of the change, and why the change is relevant.

Figures 1.2 – 1.4 provide examples of the content of a dashboard, but each client has to customize their dashboard to their own objectives, organization structure, and decision-making process. Let us consider a U.S. Pension Fund with a portfolio structure as in Figure 1.1 and a strict asset focus. (More generic European and Japanese structures are provided in Chapters 5 and 8 - the Dutch are more ALM-focused.)

This structure was first developed by the Shell Netherlands Pension Plan and coined the “Investment Decision Process” (IDP), as it clearly lays out the hierarchy of decisions. Once the structure is articulated, the CIO can delegate decisions and hold the staff responsible for performance, though the CIO is primarily responsible for ensuring that all risks are diversified and risk-adjusted return goals are achieved at the total fund level.
Figure 1.1. A typical US pension fund investment decision process.

More important, the IDP shows that decisions relating to the daily mix of Equity, Bonds and Cash account for 100 percent of the Assets under Management (AUM) and hence require maximum attention. The liability, while not shown explicitly, is the benchmark for the top box and must similarly be managed as a top priority. Manager selection is at the lowest point in the portfolio tree and therefore of lower importance/relevance. Hence, it is so much more efficient to spend more time managing beta than identifying the next most exotic hedge fund manager to whom to allocate 2 percent of the fund.

Figure 1.2 serves as a “Rear View Mirror and Speedometer” for the CIO. They can perform better than their Liabilities or strategic asset allocations (SAAs) in three major ways, as shown in the right-hand chart of Figure 1.2:

(i) Manager excess;

(ii) “Benchmark misfit” – created by (a) assigning managers benchmark indices different from the SAA benchmark indices and/or (b)
weighting sub-components of SAA indices across managers so that the aggregation is different from the SAA benchmark index\textsuperscript{19}; and

(iii) “Strategy contribution” – the value created by being dynamic/SMART in managing beta and alpha decisions.

The left side of Figure 1.2 provides the high-level summary information, about the fund, year-to-date and since inception. The focus is on excess return generated (relative to liabilities or an SAA); the relative risk taken to achieve this result; the relative return-risk ratio (or the Information Ratio), which indicates the reward per unit of risk; the $M^2$ excess – which is a performance measure presented in Modigliani-Modigliani (1997), highlighting the need to present excess returns after normalizing for absolute volatility and removing any leverage that might have been created in portfolio construction; maximum drawdown (my favorite statistic and what I call “Yield to Fire”, i.e., how much and for how long can the fund underperform before the Board loses patience and fires the manager); ratio of excess good risk to excess bad risk – again, trying to break up naïve risk statistics into an indication of good versus bad risk (with ratios above 1 being preferred); confidence in skill, which provides an indication of the CIO’s expertise in outperforming the benchmark – explored further in Chapters 2 and 3; and, finally, the success ratio or percentage of days that the performance was greater than the benchmark (a batting average and more relevant for public institutions, where being right more than 50 percent of the time may appeal more to the press than being right a few times but doing extremely well).

\textsuperscript{19} Muralidhar (2001), Chapter 9, describes this attribution in greater detail.
A smart pension fund can easily set up a process to produce such a report for its investment staff, especially for each respective branch of the tree, thereby improving overall control. For some CIOs, a daily report is too demanding, but the focus is more on process than frequency. CIOs must realize that lack of information during the month only means that investment decisions are being left unmanaged and being made by the market, not by the CIO, but the CIO is held accountable for the end result.

The next part of the Dashboard helps CIOs position the portfolio to outperform in the future (à-la a Global Positioning System or GPS). The purely hypothetical data tabulated in Figure 1.3 provides all the investment recommendations in one concise report so all the investment officers can see the recommended investment tilts. These recommendations can be derived entirely from a naïve rebalancing program, which brings all the decisions back to the SAA at a predetermined date; or they can be derived from a more intelligent quantitative process (the SMART approach proposed in Chapters 5 and 7); or they can be the result of input from all the investment officers on a purely qualitative basis. Again, though the bias is towards systematic processes, ultimately the systematic
process only formalizes effective qualitative analysis; hence, the goal is to give more structure to qualitative processes to help integrate them into the fund management operation. One may note that the sum of all recommendations at the top asset class level of all Stocks, Bonds, and Cash is zero (i.e., there is no leverage unless permitted by the Board), but that the sub-asset class level decisions add to the recommended asset class tilt. For example, the equity overweight of 5.25 percent comes from an overweight to U.S. equity of 6.95 percent and an underweight to International equity of -1.7 percent, and the same equity overweight is funded from a bond (-4.5 percent) and cash (-0.75 percent) underweight.

<table>
<thead>
<tr>
<th>Current Allocation Monitor</th>
<th>Allocation Tilt (Percentage of Portfolio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity</td>
<td></td>
</tr>
<tr>
<td>US Equity</td>
<td>➕ 5.25%</td>
</tr>
<tr>
<td>Large Cap</td>
<td>➕ 6.95%</td>
</tr>
<tr>
<td>Value</td>
<td>➕ 11.15%</td>
</tr>
<tr>
<td>Growth</td>
<td>➖ 12.46%</td>
</tr>
<tr>
<td>Small Cap</td>
<td>➖ 11.15%</td>
</tr>
<tr>
<td>Intl Equity</td>
<td>➖ 12.46%</td>
</tr>
<tr>
<td>EAFE</td>
<td>➖ 1.02%</td>
</tr>
<tr>
<td>Emerging</td>
<td>➖ 0.68%</td>
</tr>
<tr>
<td>Bonds</td>
<td></td>
</tr>
<tr>
<td>Investment Grade</td>
<td>➖ 4.5%</td>
</tr>
<tr>
<td>High Yield</td>
<td>➖ 2.61%</td>
</tr>
<tr>
<td>Cash</td>
<td></td>
</tr>
<tr>
<td>Cash Invested</td>
<td>➖ 1.89%</td>
</tr>
<tr>
<td>Euro Curr</td>
<td>➖ 0.75%</td>
</tr>
<tr>
<td>JPY Yen</td>
<td>➖ 0%</td>
</tr>
<tr>
<td>GBP</td>
<td>➖ 0%</td>
</tr>
</tbody>
</table>

Figure 1.3. The GPS – Where should the fund be allocated today?
Given our bias towards recommendations driven by systematic factors, Figure 1.4 highlights the rules affiliated with this portfolio that triggered in the last three months, and also tracks the date on which they triggered. Equally important for the CIO is the bottom part of the table, which specifies the economic parameter that moved, and by how much, to trigger a recommendation. For example, the portfolio tilt between equity and fixed income was adjusted on August 15, 2006, because of a change in the 200 day momentum indicator of the Russell 3000 US equity index.

The potential complexity of managing even a simple four-asset class pension fund (typical in Japan), where it is assumed that 20 economic factors affect the basic asset classes, is mind-boggling. It is humanly impossible for a CIO to keep track of all these data variables in his/her head; hence, a systematic process has to be established to highlight when certain

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**DEcision Drivers**

<table>
<thead>
<tr>
<th>Decision Driver</th>
<th>Time of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eq vs. Ft: 200 day momentum</td>
<td>08/31/2004</td>
</tr>
<tr>
<td>Eq vs. Ft: Oil Price</td>
<td>09/01/2006</td>
</tr>
<tr>
<td>NY vs. Euro Graded: VIX and Equity</td>
<td>08/31/2004</td>
</tr>
<tr>
<td>VIX vs. Risk Premium: Spread</td>
<td>08/31/2004</td>
</tr>
<tr>
<td>NAV vs. NAV-1: Mean Reversion</td>
<td>07/31/2004</td>
</tr>
<tr>
<td>NAV vs. NAV-1: Yield Curve</td>
<td>06/30/2004</td>
</tr>
<tr>
<td>Value vs. Growth: Growth momentum</td>
<td>06/27/2004</td>
</tr>
<tr>
<td>NY vs. Cash: Change in yield curve</td>
<td>07/31/2004</td>
</tr>
<tr>
<td>FT: Momentum Effect</td>
<td>06/30/2004</td>
</tr>
<tr>
<td>NY vs. Euro Graded: Momentum Effect</td>
<td>06/30/2004</td>
</tr>
<tr>
<td>USDC vs. INTEQ: Sentiment</td>
<td>05/31/2004</td>
</tr>
</tbody>
</table>

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- **Instill Discipline by Translating Economic Ideas into Simple Rules**
- **Rules Driven by Economic Data**

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Figure 1.4. Knowing why these decisions need to be made
economic or financial data has crossed a threshold relevant for the CIO. From the data in Figure 1.4 it is apparent, while the price of oil dropped from the preceding week, the momentum of stocks was positive and the risk indicator of U.S. equities (VIX) declined. The SMART approach makes it easier to formalize one’s basic economic intuition into a few, powerful rules across many asset pairs and let a computer track them, rather than independently attempting to work out the optimal allocations in a multi-tier portfolio in one’s head. This is explained in more detail in Chapter 4. The example of a four-panel dashboard presented (Figures 1.2-1.4) is what should, at a minimum, be made available daily to a CIO, with the ability to drill down further into any asset class or manager allocation as desired. As indicated earlier, only what is measured and monitored is actually managed.

APPLICABILITY TO ENDOWMENTS/FOUNDATIONS/ SS SYSTEMS/ SWFS

Nothing so far precludes the same principles being applied by a host of other institutional investors, though the range may span endowments, foundations, SS systems, SWFs, insurance companies, and even individual investors. For investors who focus on the illiquid bet, at a minimum, these principles should be applied to the liquid portion of the portfolio. At a more sophisticated level, a CIO in charge of a fund invested heavily in illiquid assets should spend time understanding the liquid beta replication component of the illiquid asset, so when the beta of the illiquid asset is likely to decline in performance, the dashboard helps to effectively manage these bets. In short, illiquid investments should be less in SAAs and seen more as a tactical bet made to capture the illiquidity premium (this recommendation is developed further in Chapter 3); but until such time as effective measures exist to capture volatility and illiquidity, it is realistic to expect
that good governance would entail a more beta-oriented approach to managing funds. Alternatively, where governance prevents CIOs from taking a career risk in tactically allocating to illiquid assets (as it is often a bet better taken by a Board), the two portfolios should be carved out separately, and managed as such with similar dashboards for each.

**SUMMARY**

This chapter has defined the CIO’s key responsibilities and how Boards can support their fulfillment. Though the focus is on pension funds CIOs, these findings can be used by any CIO, especially as attention is drawn to cases where the objectives or liabilities may differ but investment operations are identical. Typically, a CIO occupies a unique position between the Board and the external manager, and spends a lot of time on the mundane tasks of preparing Board presentations, attending external manager meetings, reviewing performance reports, making cash flow decisions, etc. Once the objectives are clearly articulated, the main tasks of managing assets can be outsourced, allowing the CIO to focus on the highest value-added activities: managing liabilities and beta (instead of hiring hedge fund managers). In other words, if the CIOs follow the KISS principle = Keep it Simple and SMART, it would make their lives so much easier by concentrating their focus on the pension fund structure and the goal-specific Dashboard. However, such an exercise requires adequate staffing, effective risk management, and appropriate compensation. The following chapters address the last two issues in greater detail.
Delegated Decisions and the Capital Relative Asset Pricing Model

“The reports of my death are greatly exaggerated!” Mark Twain

BACKGROUND

It is popularly known that Mark Twain, on reading his own obituary, had remarked: “The reports of my death are greatly exaggerated!” In a similar vein, one might be tempted to make the case for the CAPM, the “indisputable” foundation of modern investment theory. Ever since its introduction over 50 years ago, researchers have attempted to test the theory with market data, and have found several ways to denounce it or alternative ways to resuscitate it. Even The Economist published a series of articles in 1999-2000 on how the real options theory or research on the flow of funds threatened the CAPM’s validity. Yet the model continues to persist as the backbone of finance theory as it evolves into the new millennium. However, the recent market downturn and a renewed focus on new paradigms for managing funds and manager compensation suggest that this is the perfect time to review the CAPM and propose a new paradigm. This is particularly relevant for CIOs of pension funds, as they have either been using the CAPM to value assets or have hired managers who use the CAPM as the basis of decision-making.

20 http://www.cs.cmu.edu/~ralf/quotes.html
This chapter exposes the flaws in the current CAPM and suggests that CIOs would do well to reassess consultants and asset managers who anchor their decision process to the traditional CAPM. After a brief review of the CAPM theory which highlights its appeal, it presents the rather simple reason for the inaccuracy of many previous tests of the CAPM’s validity – namely, that the CAPM’s beguiling allure is its very simplicity, but its applicability pertains to only a limited class of investors who may have become a small fraction of the market. However, changes in the behavior of individuals and in pension systems (including large social security systems) and other institutional investors could impact this trend. Though still not complete in developing the new asset pricing paradigm, the chapter concludes by charting some fresh directions which are likely to form the basis of a new paradigm for asset pricing. The research presented here has implications for objective setting (Chapter 3), risk budgeting and compensation (Chapter 7), and investment decision-making (Chapters 5, 6, and 8).

**THE TRADITIONAL CAPM**

The CAPM associated with Markowitz, Sharpe, Littner, etc., makes the simple assumption that the representative investor has a desire for greater wealth and an aversion to the volatility of wealth (called mean-variance preferences).

A typical utility function would be of the type:

\[
\text{Maximize } E[r] - \pi^* \sigma^2,
\]

where \(E[*]\) is the expectations operator, \(r\) is the return of the portfolio, \(\pi\) denotes a measure of the investor’s risk aversion, and \(\sigma\), the portfolio’s volatility.
By this definition and a few simplifying assumptions about asset returns, it is possible to determine an asset’s equilibrium price independent of individual preferences. The expected risk premium of a risky asset (defined as the expected return minus a risk-free rate) is the product of the asset’s beta (defined as the covariance with the market portfolio divided by the variance of the market portfolio) and the market risk premium (defined as the expected return of a market portfolio minus a risk-free rate). The beta may be expressed as:

\[ \beta_a = \frac{\sigma_a \rho_{a,m}}{\sigma_m}, \quad (2.2) \]

where \( \beta_a \) is the beta of asset \( a \), \( \sigma_a \) is the volatility of asset \( a \), \( \sigma_m \) is the volatility of the market portfolio (or the benchmark portfolio), and \( \rho_{a,m} \) is the correlation between portfolio \( a \) and the market portfolio.

In CAPM theory, the market portfolio is the value weighted aggregate portfolio composed of all the risky assets. Therefore, if the historical beta\(^{21}\) of an asset (or a portfolio of assets), the expected return of a portfolio broadly representative of the market, and the expected return of a risk-free asset (such as a Treasury note or Treasury bond, but theoretically with zero volatility) are known, it would be possible to determine the expected return and thus the price of the risky asset. Since the market portfolio is not a readily observed portfolio, people have assumed that market benchmarks representing a broad aggregate of risky assets

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\(^{21}\) As it is difficult to know the true beta of an asset, investors assume that the historical beta measured relative to the “market” is an accurate representation of the future. More important, a true risk-free asset does not exist.
(e.g., the Wilshire 5000 or the S&P 500) are reasonable proxies to apply this theory.\textsuperscript{22}

To put it simply, beta is the product of the asset’s (or portfolio’s) correlation vis-à-vis the market portfolio and the asset’s (portfolio’s) standard deviation, divided by the market portfolio’s standard deviation, as shown in equation 2.2. Since beta is a measure of co-variance of an asset\textsuperscript{23} with the market portfolio, a beta higher (lower) than one implies that the asset would have a return higher (lower) than the market portfolio. An asset with a zero beta is a risk-free asset, and the most risky assets have positive betas greater than unity.

In addition, it has been demonstrated that every investor would hold their assets in some proportion of the risky market portfolio and the risk-free asset, commonly known as the Two-Fund Separation Theorem. Individual preferences enter the picture only in the proportion of these two broad asset classes, as risk-averse investors would hold more of the risk-free asset whereas investors with a tolerance for risk would be more heavily invested in the infamous “market portfolio”.

More complicated versions of the CAPM exist; however, the theory’s essence has been preserved, as researchers sought to extend its framework to a situation where the markets were reviewed over multiple periods (Intertemporal CAPM\textsuperscript{24}) or over different national boundaries (International CAPM\textsuperscript{25}). By virtue of its simplicity of excluding individual preferences and the reliance on the simple data

\textsuperscript{22} In theory, the market portfolio should represent risky equities and bonds in both domestic and international markets. However, it has been difficult to identify a true market portfolio in practice; hence the use of proxies.

\textsuperscript{23} We use the words “asset” and “portfolio” (of assets) interchangeably, as a “portfolio” is a collection of many “assets”.

\textsuperscript{24} Merton (1973).

\textsuperscript{25} Solnik (1974).
series, the CAPM lent itself to widespread appeal and a battery of tests, which were split between extolling its virtues and faulting it for not bearing out well under tests of this rather simple relationship. However, the CAPM’s simplicity lies in the assumptions it makes about the representative investor, and therein lies the problem as also the pathway to the new paradigm for asset pricing.

A consideration of the foregoing analysis may lead a modern investor with no training in finance to conclude that the one aspect conspicuous by its absence from the early expressions of the theory is the time dimension; and it is a foregone conclusion that time matters in the investment decision-making process. After all, the CAPM suggests that the representative investor would be willing to accept the returns on a portfolio over the long term if it met the asset pricing rule, regardless of the path achieved over time vis-à-vis the market portfolio. The Intertemporal CAPM assumes the market is always in equilibrium and captures time in its analysis, but not adequately to satisfy the average investment policy-maker. The classic investment policy-maker is not indifferent to a portfolio’s return path, even if he is assured that the final outcome might be the satisfaction of the CAPM-predicted return. This is because he could get fired for underperformance (which suggests lack of skill) before the long-term return is achieved. In an interesting way, the correlation coefficient captures the path of the portfolio relative to the market portfolio, and it is shown later that an investor will not be indifferent to two identical betas (see also Chapters 3 and 7).

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26 Some have pointed out that testing for expected return theories by using realized returns is incorrect, and it is therefore necessary to qualify these studies.
“I suppose you think that on our board half the directors do the work and the other half do nothing. As a matter of fact, gentlemen, the reverse is the case.”\textsuperscript{27}

Let us digress briefly to identify two constituent classes of investors in the market, namely, those who own the funds (i.e., principals who may or may not invest on their own behalf) and those who make investment decisions on behalf of the principals (i.e., agents).\textsuperscript{28} This distinction is important, as major developments in the asset management industry in the last 40 years require the incorporation of the time dimension and a clearer understanding of relative risk into any asset pricing theory.

Assets controlled by pension funds (principals) in the United States have grown dramatically, leading, it is believed, to a similar growth in institutional fund management, because a significant portion of these assets are externally managed, with delegated discretion within the parameters of investment guidelines. In addition, the mutual fund industry (agents) has experienced similar asset growth, also with delegated decision-making (Swensen 2005, page 210). Clearly, the use of agents has increased over time as has their share of the total market. Two other phenomena in capital markets today are noteworthy: (i) more individuals are taking control of asset decisions through either DC funds or day trading; and (ii) a more marked leaning towards indexation or passive management is perceptible, as investors tend to believe that they have overpaid

\textsuperscript{27} Petras (2001), page 18.

\textsuperscript{28} Brennan (1993) makes a similar distinction between individuals and agents. More recently, Cornell and Roll (2004) have extended this analysis. We will return to this classification later.
managers for services rendered. This reversal of trends suggests that more principals are making (or taking control of) their own investment decisions. This begs the question, how does the CAPM apply to these groups of investors and how does the shift in delegation of authority affect the pricing of assets?

CIOs are at the crossroads in this theoretical framework of principals and agents: they have to play on both sides of the fence, as shown in Figure 2.1. In pension funds, the CIO often reports to a Board composed of employer and employee representatives (principals), and serve as an agent in this relationship. However, once the CIOs select external managers (agents), they function as principals. In general, the relationship between principals and agents is complex in three fundamental areas: (i) the average horizon of a pension fund (i.e., a principal) is the long term (defined as 30-40 years), whereas the average performance measurement period of those hired to manage these funds (i.e., agents) is the short term (annual and, in some extreme cases, even monthly); (ii) agents are measured relative to a benchmark and expected to outperform at least on an after-fees, risk-adjusted basis (i.e., not paid for free leverage and beta); and (iii) a nagging suspicion lurks that this outperformance by agents results from luck rather than skill, and that the time by which this is realized usually far exceeds the measurement horizon. In other words, the last-mentioned issue suggests that principals pay the agents salaries or fees, but lack the confidence in the short return data series available to them to be convinced that the agent’s outperformance vis-à-vis the benchmark is based on skilled judgment, or that, in turn, the fee is well deserved. This is largely because, unlike the sciences where engineers and doctors are rigorously trained and tested before they qualify for
major responsibility, no clear norm is available to distinguish *ex-ante* who would make a good asset manager.

From the agent’s point of view, marked underperformance in any period is a strong disincentive, as they need to protect not only returns but also (by corollary) their own reputation. This explains, in part, the growth of passive index funds with its residual implications, as also the rise of the carry trade in currency markets, it being easier to lock in a positive carry and hope that currency appreciations are less than the interest rate differential. Covered interest rate parity would suggest that the currency with the higher interest rate would depreciate to offset the interest rate differential, but it has been shown, time and again, that the simple carry trade across multiple currencies is profitable.\(^{29}\) These issues are important, as

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\(^{29}\) See Strange (1988), and Baz, Breedon, Naik, and Peress (1996).
they can distort market performance away from standard economic theory – the crux of the argument in this chapter.

Take the carry trade example again: it takes minimal conviction for an agent to implement a positive carry trade, but it takes enormous conviction and deep pockets for an agent to implement a negative carry trade. If enough (low conviction, out-for-a-quick-buck) agents buy high-interest-rate currencies, the high-interest currency will appreciate because of disproportionate demand (the low-interest-rate currencies will be under pressure to depreciate, thereby defying standard economic theory at least for a reasonable period of time). However, if every agent is on a single side of a trade when they are risk-seeking, the trade looks attractive until risk aversion sets in (and this can be caused by exogenous or endogenous factors), and then low-interest-rate currencies appreciate dramatically as money rushes home to countries with high savings rates that exported capital in the risk-seeking mode. This was evidenced most clearly when Russia defaulted on its debt and the Japanese yen appreciated dramatically in a single day. Since then, many banks have created carry trades conditioned by risk aversion, but the theory has never been explained in terms of principals and agents.30

The current theory on skill versus luck states that (i) the greater the confidence required to make this distinction, (ii) the higher the volatility of assets, and (iii) the lower the correlation between the portfolio and the benchmark, the greater is the number of years required to separate luck from skill.31 Since, after an agent is

30 Muralidhar (2001b).

31 For example, for a portfolio that has outperformed by an annualized 300 bps, where the annualized standard deviation of the benchmark is 15 percent, the annualized standard
hired, the length of time for determining his luck from his skill is considerable, it is important to see how this affects the behavior of principals and agents. The existing literature on the generic problems of principal-agent relationships is comprehensive, and academics are now trying to establish whether performance-based fees will align interests more closely in the fund management industry. However, this does not appear to solve the luck versus skill problem completely, or what the academic literature calls “incentive compatibility”; and these academic proposals do not adjust for risk in the performance-based fees. Surely, no principal would choose to hire an agent who has generated returns based purely on luck, and clearly would not want to compensate them. This problem manifested itself on Wall Street over a long period of time but became obvious only recently in 2008 when bonuses paid at the consummation of a transaction were revealed to be for trades that did not have any long-term value!

While investment policy-makers (and asset management firms) are concerned about fees in any period, a more critical concern is job risk – as the termination of a job or mandate after weak relative performance (either to the benchmark or the competition) not only cuts off the future revenue stream, but has implications for reputation as well. Finally, no investment policy-maker would want to be in a position where they fired a “good” manager based on a short period of underperformance.

In brief, both principal and agent cannot be indifferent to the performance of the benchmark and of peers, and the path of a portfolio over time vis-à-vis a deviation of the portfolio is 25 percent, and the correlation is 0.9, for 84 percent accuracy one would need 175 years of data! See Ambarish and Siegel (1996) and Muralidhar (1999) for the application to fund managers, and Muralidhar and U (1997) for the application to pension fund peer evaluations.
benchmark. It would take a courageous fund manager to choose a portfolio independent of, or with a weak correlation to, the benchmark, as this would imply a high tracking error (defined as the standard deviation of the benchmark’s excess returns) and large drawdowns. Principals, acting on their own, do not harbor such suspicions, as they know the basis for their decisions, do not have to pay any fees, and can therefore make investment decisions independent of these factors.

This is the focal point of this chapter: The principal, as the true representative investor in the traditional CAPM, may value assets as such, whereas an agent has a more complex trade-off to make among such valuations and the performance of the benchmark and that of competitors.

Thus, for an agent, factors beyond those embedded in the naïve CAPM affect the valuation of portfolios, eventually influencing buy/sell decisions which, in turn, impact security prices. Therefore, earlier tests of the CAPM that did not take into account market structure and the factors driving demand for assets by different types of investors are incorrect. Tests of the traditional CAPM that rejected it reject only the fact that not all investors are principals! By ignoring market structure and behavioral issues, these tests have the correct answer, but probably the wrong hypothesis.

As indicated above, the concentration of assets in pension funds is increasing, and the growth of mutual funds represents a fundamental change in the nature of asset markets and the investment environment. To the extent that agents’

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32 The tracking error is a function of the volatility of the benchmark and the portfolio, and the correlation of the portfolio to the benchmark. A low correlation is equal to a high tracking error. A high tracking error implies not only a significant amount of relative risk, but also a long time period to separate luck from skill.

33 The beta that one would test for, using the theoretical paradigm, is unobservable, as the historical beta is polluted by the actions of agents. Therefore, historical betas will need to be decomposed into a pure component and an agent-biased component.
activities cause inaccurate pricing of securities, at least in the minds of CAPM purists, either the current form of the CAPM is no longer valid (unless the trend of using agents is completely reversed), or a new paradigm needs to be developed, or prices are at risk of undergoing a significant correction. The problem encountered is: what are the preferences implied by these complex relationships (individually and in aggregate), and what proportion of the market do they constitute?

The answer to the first question will give an indication of how prices and returns should be evaluated by the respective investor classes; and the answer to the second will indicate the impact that these prices and returns will have on determining price levels in equilibrium. The use of external asset managers has increased (Swensen 2005 and Bogle 2009) and, based on the available statistics, this suggests that agency risk issues impact on a large section of the market.

NEW APPROACHES FALL SHORT

The traditional CAPM is an absolute theory of asset pricing and relies on the valuation of assets based on an ephemeral market portfolio, whereas the marketplace is replete with benchmarks such as the S&P, Russell equity indices, and JP Morgan bond indices for U.S. clients; TOPIX or Nikkei for Japanese clients, etc. Moreover, the original CAPM pre-dates the need for benchmarks, as it was introduced when the market was dominated by principals. What is needed now is a complementary relative theory of asset pricing of which the current CAPM is a very special case (i.e., a relative theory of asset pricing as the base for all finance theory). It has already become a practice for participants in the asset
management industry to use relative risk measures to evaluate the risk inherent in their decisions, and therefore a relative theory of asset value is a logical extension.

For example, pension funds often consider the tracking error (defined here as the volatility of excess returns) of their investment managers as a part of both an evaluation of prospective managers and a review of current managers. Some early research suggests that agents who receive “pure” performance fees will price assets based on two factors: the market and benchmark portfolios, as opposed to the standard CAPM which depended on only a risk-free asset and the market portfolio. In this new paradigm, the “risk-free asset” becomes the benchmark by which the agent is evaluated! Specifically, portfolios that have a higher correlation with the benchmark will be bid up and have a lower expected return.\(^{34}\) This is a critical step in the direction of a relative theory; but, by his own admission, Brennan (1993) states that this simple analysis of a single period incorporates neither the analysis of luck versus skill nor whether such an arrangement is optimal for the pension fund or the asset manager. Cornell and Roll (2005) extend Brennan’s theory, but again seem to overlook the practical nuances in the industry – namely, they attempt to model the asset manager’s penchant for higher revenue (for less risk), but do not attempt to establish the optimal contract between principal and agents, given the principal’s desire to find skillful, high-performing asset managers (on a risk-adjusted basis).\(^{35}\) The empirical tests of this theory seem to shed light on the possibility that this theory would

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\(^{34}\) Brennan (1993).

\(^{35}\) See Muralidhar (2001), Chapter 9, for discussions on luck versus skill and the correct method for risk-adjusted performance. Muralidhar (2009) and Chapter demonstrate how the compensation of asset managers needs to be modified to adjust for risk and skill.
work, but the wrong assumption on the growth of passive indexed funds, managed through mutual funds, clouded some of the results. In fact, the reason for Brennan (1993) arriving at this conclusion is in the definition of the types of investors. If an increase in passive management is viewed as individuals/principals taking more control of their assets (i.e., delegating only execution and not discretion to their fund managers), rather than increasing the agents’ proportion of the market, then the empirical results of Brennan (1993) tend to ratify this concept of a relative theory. In other words, if Brennan had adjusted the data set for a mischaracterization of principal/passive behavior, his tests may have validated the theory.

Academic research has scanned the structure of mutual fund fees to ascertain if asset selection has been influenced by these contracts. They seem to conclude that the fulcrum-type fee arrangements distort portfolio allocations in a way that results in a positive effect on equilibrium prices of stocks in benchmark portfolios, a significant negative effect on their Sharpe ratios, and a marginally positive effect on their volatility. Clearly, the price action on stocks in the case of Deutsche Telekom, or even country indices as in the case of Malaysia, when they are included in the benchmarks, seem to bear out the conclusion, if not the hypothesis. The issue that arises from starting with the assumption that fund managers try to maximize fees is its failure to recognize that fund managers are more likely to worry about risk-adjusted outperformance vis-à-vis the benchmark and competitors, and convincing their current and prospective clients that they are the most capable of adding such returns, than they are concerned about optimal fee contracts. Hence, the need for appropriate risk-adjusted and skill-based fee contracts (Muralidhar 2009a and Chapter 7). Further, in my 14 years of
involvement in the asset management business, I have yet to come by either a pension fund or a fund manager who used fee negotiations as a way of determining who is a capable manager – instead, the signaling is done through performance data.

The following section presents a methodology by which the signaling can be done through performance, especially risk-adjusted performance, which achieves many of the above-mentioned goals (including optimal fee arrangements) and provides the general framework for the new paradigm.

**THE NEW PARADIGM – THE CAPITAL RELATIVE ASSET PRICING MODEL**

In addition to Brennan (1993) and Roll and Cornell (2005), two relevantly recent pieces of research have sought to answer the questions raised above – namely, (i) how does one compare a manager’s returns relative to a benchmark on a risk-adjusted basis, as well as the performance relative to peers? And (ii) how does one distinguish between a manager’s luck and skill measured relative to a benchmark, and what length of a report card will demonstrate the asset manager’s skill with any degree of confidence? To resolve the first, Modigliani and Modigliani (1997) show that in order to compare a portfolio to a benchmark in terms of basis points of risk-adjusted performance, one must ensure that both have the same standard deviation. Therefore, it has been proposed that the portfolio be leveraged or deleveraged, using the risk-free asset. This transformation is demonstrated in Figure 2.2. It

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36 Modigliani and Modigliani (1999), and Muralidhar and U (1997).
37 Ambarish and Siegel (1996), and Muralidhar (1999).
creates a new portfolio, called the risk-adjusted portfolio (RAP), whose return ($M^2$ or M-square) would be equal to the leverage factor multiplied by the original return plus one minus the leverage factor multiplied by the risk-free rate and is explained in detail in Chapter 3. It should be apparent to the intuitive reader that this is a form of the Two-Fund Separation. Now, it is possible for the RAP to outperform the benchmark only by taking into account the tracking error (or having a correlation less than one).\(^{38}\) The adjustment allows for a comparison of “apples to apples”, namely, returns from both the benchmark and the RAP have the same volatility. The authors were able to show that peer rankings can be reversed when such an adjustment is made. The astute reader will see that if a manager is told to outperform a benchmark on an absolute basis, the simplest way to do so is to borrow money and use the funds to invest in the benchmark – thereby gaming the mandate.

A counter-intuitive result of this approach, not envisioned by the Modiglianis, is that if the RAP outperforms the benchmark (with the same standard deviation as the benchmark) and has a correlation less than one, then if the benchmark was the market portfolio, one has created a portfolio with a beta less than one outperforming the benchmark.\(^{39}\) In effect, managers of RAPs can only outperform

\(^{38}\) If the portfolio’s volatility is set equal to the benchmark, then the tracking error or risk relative to the benchmark can be generated only by maintaining a correlation less than one.

\(^{39}\) Roll (1992) had posed such a problem but could not explain the outcome. Also, the correlation of the original portfolio to the benchmark will be identical to the correlation of the RAP to the benchmark, as “leverage or deleverage” using the risk-free rate does not change the correlation characteristics. However, a CAPM purist will conclude that such a result is obtained, as the benchmark is not the market portfolio and hence makes no comment on market efficiency. Also, the recent work by Jorion (2003) has shown that the best way to optimize tracking error is to ensure that the standard deviation of the benchmark is equal to that of the manager. However, Jorion (2003) surprisingly does not reference or acknowledge Modigliani and Modigliani (1996).
by being skillful in taking correlation risk! Therefore, in the relative paradigm, beta appears to be less important than the benchmark’s volatility and the portfolio’s correlation to the benchmark. In effect, finance theory must move into a three-dimensional paradigm (without even adding time) of return, correlation, and volatility, as opposed to the standard risk-return paradigm. More important, two portfolios with identical betas may not be equally desired by a principal who cares about the fund manager’s skill, as demonstrated later and in Chapter 7.

The $M^2$ measure and its unique insights are shown in Figure 2.2, which highlights four key regions:

I. Portfolio outperformance on an absolute and risk-adjusted basis.

II. Portfolio outperformance on an absolute basis and underperformance on a risk-adjusted basis.

III. Portfolio underperformance on an absolute and risk-adjusted basis.

IV. Portfolio underperformance on an absolute basis and outperformance on a risk-adjusted basis.

This paradigm has been extended by Muralidhar (2000) and repeated in Chapter 3, which shows that the performance of asset managers can be normalized for differences in correlations to the benchmark as well. In the revised paradigm ($M^3$ or M-cube), correlation-adjusted portfolios (CAPs) are created: these combine the optimal mix of the active managers, market benchmark, and risk-free asset (Three-Fund Separation) to ensure that not only is the standard deviation of CAP equal to the standard deviation of the benchmark, but also the correlation of CAP is equal to some target (which is uniquely selected, based on the relative risk budget). The second condition is needed to ensure that all CAPs have the same target tracking error (or relative risk), derived with identical standard deviations.
and correlations. A shortcoming of these measures is that they do not take the length of track record into consideration, i.e., the time factor is ignored.

To resolve the luck versus skill question, time and the degree of confidence are critical factors, as are the returns, standard deviations of the portfolios and the benchmark, and the degree of correlation between the two. The problem is that performance data can contain considerable noise, and the more volatile the portfolio and a manager’s excess return series, the greater the noise and, hence, the more the time needed to resolve this issue. Ambarish and Siegel (1996) suggests that even a 300-basis point outperformance may require 175 years of data to claim, with 84 percent confidence, that the manager is skillful. The Ambarish and Siegel (1996) approach is specified in greater detail in Appendix 2.1 for the interested reader. However, a noteworthy result is that when the portfolio’s standard deviation is set equal to the benchmark’s standard deviation,
as in the RAP, for a given standard deviation of the benchmark and degree of confidence, the time required becomes a simple function of the correlation parameter – the lower the correlation, the more the time required. Moreover, as shown in Muralidhar (2000), once the correlation adjustment is made, the rankings based on the $M^3$ are identical to those made on the basis of skill for an equivalent length of track record. Hence, Muralidhar (2002) – summarized in Chapter 3 – extends this paradigm to show how agents with different lengths of track record can be compared to one another by incorporating their full track record, thereby bringing time into the equation. However, the potential flaw in Muralidhar (2002) is that it assumes a unique (and conceptually unspecified) objective function, thereby making it less than perfect for a general result. Here is the conundrum that these propositions yield: the Modigliani adjustment suggests that managers can get more risk-adjusted outperformance by lowering the correlation; the skill versus luck measure says that those actions will either lower the confidence in the manager’s skill or extend the time period under evaluation. However, what is critical is that the correlation measure is an important part of the portfolio selection process and not a parameter that is blindly folded into a beta measure. Hence, the confidence in skill for two portfolios with identical betas but very different correlations is not the same. The implications of this result for optimal risk budgeting is demonstrated in Chapter 7. Let us illustrate this with a simple example: Interestingly, for a given relative risk, one can create many portfolios with different betas, the portfolio with the highest beta being the one in which one can have the most confidence in skill (assuming that the length of track record and excess returns are identical). Conversely, even for the same beta, a principal is not indifferent when faced with the choice of two
identical betas. Consider two portfolios with identical betas: (i) correlation of 1, portfolio volatility of 12 percent, and benchmark volatility of 10 percent gives a beta of 1.20; and (ii) correlation of 0.985294, portfolio volatility of 8.5 percent, and benchmark volatility of 7 percent also gives a beta of 1.20. Both have identical tracking errors (2 percent), excess returns and length of track records (2 years), but the confidence in skill in the first case (88.81 percent) is higher than in the second case (87.35 percent).\textsuperscript{40} Clearly, a principal with a limited time frame to evaluate these two portfolios would prefer the second portfolio, even though the excess returns and betas are identical, whereas a principal with a very long time horizon or managing assets themselves might be indifferent to whether she chose one portfolio or the other. This analysis would seem to be a violation of the CAPM, but from a relative perspective may appear to be quite reasonable. For a CAPM purist, the risk-free rate is a Treasury security; for a relative theory believer and practitioner, the risk-free rate is the benchmark, whether it is the S&P 500 or the JP Morgan Bond Index. Therefore, from a theoretical point of view, some measure of correlation will have to be included in the “optimal fee contract”, as it becomes a gauge of the fund manager’s skill (see also Chapter 7). The $M^3$ measure of Muralidhar (2000) starts to align these issues more accurately by normalizing for correlations and obtaining rankings that are identical to those based on confidence in skill, but stops short of asking the more fundamental question: what is the implication for asset pricing when agents start to behave in this way?

\textsuperscript{40} Muralidhar (2009b). Note that it is not possible to have the same beta for the same benchmark volatility.
To keep the analysis simple, the time factor will be ignored (even though this is incorrect) which adds a fourth dimension without necessarily helping to clarify how assets are valued and optimal portfolios selected in the Three-Fund Separation Theorem. As indicated above, the formulae for confidence in skill can be used to create iso-confidence curves – i.e., combinations of returns of a portfolio relative to a benchmark, volatility of a portfolio relative to a benchmark, and correlations that give the same confidence in skill, as specified in Ambarish and Siegel (1996) and enhanced in Muralidhar and U (1997) and Muralidhar (2001).

The relative return objective function is repeated here:

\[
\text{Maximize } E[r_a - r_b] - \pi \sigma_{(a-b)}^2,
\]

where \(E[\cdot]\) is the expectations operator, \(r_a\) is the return of the portfolio and \(r_b\) is the return of the benchmark, \(\pi\) denotes a measure of the investor’s risk aversion, and \(\sigma_{(a-b)}\), the portfolio’s tracking error.

The three-dimensional iso-confidence curves are plotted in Figure 2.3 for a hypothetical market portfolio with an expected standard deviation of 10 percent. For simplicity, the iso-confidence curve is plotted in decrements of 5 percent, starting with 95 percent and assuming that the excess annualized return is 1.5 percent and even then the chart is not pretty. As with typical economic theory, this iso-confidence curve can be seen as the budget constraint for agents. If we now superimpose the principal’s objective function, as in equation (2.3), but with the caveat that they do not want their relative risk to exceed 3 percent, as every
A good principal should budget risk optimally (Chapter 7), a utility curve can be drawn in three-dimensional space of excess return, volatility of the portfolio, and correlation (or four dimensional space if we add time). If the principal adds the additional condition à la $M^2$ that the portfolio cannot have volatility different from that of the benchmark, then a unique portfolio is selected.

**CHALLENGES FOR ACADEMIA – DEVELOP THE NEW PARADIGM**

Investors have typically proceeded on the faith that a market portfolio exists. Academia will need to help us isolate such market portfolios with a more general equilibrium theory of asset pricing. However, assuming that the principal-selected benchmark is the market portfolio, then – given different objective functions and
absolute risk aversions (i.e., different $\pi$) and different target risk budgets composed for choice of confidence in skill – the optimal mixes of the risk-free asset and benchmark will be chosen by different investors (and hence a three-dimensional Relative Capital Market Line).

**SUMMARY**

In my experience with many investment benchmark studies (also known as asset-liability studies), either as a member of a team entrusted with the management of institutional funds or as an associate with firms engaged in such an exercise, one of the most common assumptions was that the returns of the asset classes under consideration were driven mainly by a CAPM framework. In essence, these institutions make investment policy decisions at a strategic and tactical level, assuming that the returns on the asset class benchmarks are determined independent of their actions. Individually, this may be true but, in aggregate, asset markets will clearly be affected. For example, the increasing selection of a particular benchmark will potentially lower the returns of that benchmark; and further, depending on the relative risk that principals permit, returns on assets over time will be impacted, subject to how they co-vary with these benchmarks. This is important, as it has the potential to skew the price of assets that people choose and also those that are excluded from such benchmarks. The issue of benchmark selection is addressed in Chapter 3 which examines benchmarks from the perspective of efficiency, ease of implementation, market completeness, and cost.
However, academic theory and empirical results increasingly seem to lean towards assuming that returns are impacted by the behavior of principals and agents; and the challenge will be to determine a comprehensive asset pricing theory that captures this inter-relatedness of action and valuation of assets (and potentially, the optimal contracts between principals and agents - specified in Chapter 7). It would be interesting to see if, as in the physical sciences, a relative theory can be determined, where the absolute theory along the lines of Markowitz (1959) is just a stylized case of the relative theory. This would lead to different valuation measures, based on the nature of aggregate principal-agent relationships. What this clearly shows is that earlier studies of SAA, Optimal Portfolios, etc. are flawed, as proved by the economic meltdown of 2008.

The trick will be to establish what constitutes a risk-free asset as well as include a dimension of the correlation of assets/portfolios to investment benchmarks to capture not only risk adjustment but also an element of measuring skill. Therefore, the correlation term will gain more importance than is currently assigned to it by the pure CAPM framework (as a subordinated element of the beta), and it will be the focus of more attention in any new relative asset valuation paradigm. This is developed in greater detail in Chapter 4 where the lack of correlation between two assets is shown to have implications for the dynamic management of assets. The above discussion suggests that the new paradigm is on the cusp of being developed, as the individual pieces have already been devised, and the challenge now is to assemble it all in a consolidated framework. Though this may not signal the death of the CAPM, it would certainly be a reincarnation in a different frame of reference, sending out a call to CIOs to be careful how they manage assets and possibly move to a less predictive approach
to asset allocation and a more dynamic factor-based approach to relative allocation (see Chapters 5, 6, and 8).

Appendix 2.1 - The Luck versus Skill Formulation

Outperformance over a benchmark unfortunately does not tell the investor whether the external manager or the mutual fund manager is skillful. Nor does it provide the investor with a measure of confidence that they can have the alpha generated by skill-based processes. Critical factors involved in answering the luck versus skill question include time, the desired degree of confidence, the investment returns of the portfolio and the benchmark, the standard deviation of the portfolio and the benchmark, and the degree of correlation between the two. The problem is that considerable noise is inherent in performance data, and the more volatile the portfolio and a manager’s excess return series, the greater the noise and, hence, the more the time needed to resolve the issue. Ambarish and Siegel (1996) demonstrate that the minimum number of data points, or time horizon \( H \), should be large enough for skill to emerge from the noise or, equivalently,

\[
H > S^2 \left( \sigma_1^2 - 2 \rho \sigma_1 \sigma_B + \sigma_B^2 \right) \frac{1}{\left[ \left( \frac{r(t) - \sigma_1^2}{2} \right) \left( \frac{r(B) - \sigma_B^2}{2} \right) \right]^2},
\]  

(A.2.1)
where \( 1 \) is the manager, \( B \) the benchmark, \( r \) the return, \( \sigma \) denotes the standard deviation, \( \rho_{1,B} \) the correlation of returns between the manager and the benchmark, and \( S \) is the number of standard deviations for a given confidence level. Their resolution appears theoretically more appropriate and simpler than statistical process control alternatives such as Philips and Yashchin (1999).\(^{41}\)

If the tracking error \( TE \) of portfolio 1 versus the benchmark is defined as the standard deviation of excess returns, it is trivial to define \( TE(1) \) as follows:

\[
TE(1) = \sqrt{(\sigma_1^2 - 2\rho_1\sigma_1\sigma_B + \sigma_B^2)}.
\]  

(A.2.2)

*Note:* The second term in the numerator of the confidence-in-skill calculation, or equation (A.2.1), is the same as the square of the \( TE \) of portfolio 1 versus the benchmark.

Equation (A.2.1) suggests that even a 300-basis point outperformance may require 175 years of data to claim, with 84 percent confidence, that the manager is skillful.\(^{42}\) Muralidhar and U (1997) and Muralidhar (1999) recognize that \( H \) is often given by performance history, and therefore solve for the degree of confidence \( S \) instead.

Equation (A.2.1) makes it clear that the confidence-in-skill calculation is intricately linked to the information ratio (\( IR \)). The annualized \( IR \) is equal to the annualized excess return divided by the annualized \( TE \) or:

\[^{41}\text{One of the problems of Philips and Yashchin (1999) is that the user is required to specify an information ratio above which funds would be rated good. In the technique employed here, no such classification is required.}\]

\[^{42}\text{This result is from outperformance engendered through 13.2 percent basis points of tracking error, where the benchmark standard deviation = 15 percent, the actual standard deviation = 25 percent, and the correlation between the two was 0.9.}\]
\[ IR(1) = [r(1)-r(B)]/TE(1). \]  
\[ (A.2.3) \]

As a result, and using (A.2.2) and (A.2.3), equation (A.2.1) can be rewritten in terms of \( S \), where \( S \) is a function of \( IR \):

\[
S < \sqrt{H} \left[ IR(1) - \left( \frac{\sigma_1^2 - \sigma_B^2}{2TE(1)} \right) \right]. \tag{A.2.4}
\]

The confidence in skill is derived from converting \( S \) to percentage terms for a normal distribution or the cumulative probability of a unit normal with a standard deviation of \( S \) \( (C(S_1)) \), and this will be the measure of the confidence in skill. This measure will lie between 0 percent and 100 percent, and hence acts as a probability measure. For example, when \( S \) is equal to 1, then \( C(S) = 84 \) percent.

Also, when the second term in equation (A.2.4), i.e. \( \left( \frac{\sigma_1^2 - \sigma_B^2}{2TE(1)} \right) \), is generally small or insignificant, the \( IR \) and the length of data history will largely determine the confidence in skill. This is the case when the tracking error is substantial and driven largely by a low correlation between the portfolio and the benchmark (i.e., \( \sigma_i \cong \sigma_b \)). As a result, two portfolios with identical variances, information ratios, and tracking errors but differing only in length of history will have a different confidence in skill – the longer the history, the greater is the confidence.
New Performance and Risk Measures and a New Approach to Passive Management

“We had to add a third dimension: the time dimension...If you don’t add time, you’ll find nothing.” Zhichun Jing, Chinese archaeologist

BACKGROUND

In the fund management industry, the importance of asset returns has been overemphasized, and the tendency has been to exalt the CIOs who generate the highest return in peer rankings, while treating with disdain those bringing up the rear. The many levels at which this emphasis is wrong are mentioned briefly before proceeding to suggest a new approach.

1. First, for a typical CIO, assuming that a liability needs to be serviced or some goal to be achieved, the true measure is not the absolute asset return, but rather the return relative to a liability. Therefore, the performance rated best in the country where the liability return may be twice as high is just wrong. The best absolute performance may be small

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43 National Geographic, July 2003.
consolation, but typically such discomfiting data is glossed over by the media.

2. Second, care must be taken to subtract all costs from the return, as the industry mistakenly tends to assume that the benchmark can be costlessly reproduced. In fact, a true assessment of a CIO’s skill should be arrived at post a deduction of costs. (This leads us to a discussion on appropriate benchmarks later in the chapter.)

3. Third, as return is not independent of the risk taken to achieve it, risk-adjusted returns are the appropriate criterion. The key will be to ensure whether the risk measure is absolute risk or relative risk.

4. Fourth, in today’s evaluation, the lack of liquidity in investments is given a free pass; hence, ideally, cost- and risk-adjusted relative returns must be further adjusted for lack of liquidity. This was most evident in 2008 when the stars of the previous decade bit the dust: the unforeseen lack of liquidity caused CIOs to panic and desperately liquidate any asset to generate the requisite cash.\(^{44}\)

5. Time is of the essence – one period’s good performance pales into insignificance given the noise in performance data. Hence, the entire history of performance (and commensurate risks) and an analysis of skill need to be considered for a realistic ranking of all CIOs.

\(^{44}\) The traditional growth of continuously compounded asset returns \( g = \mu - \sigma^2/2 \), where \( \mu \) is the asset’s expected rate of return and \( \sigma \) is the standard deviation of returns. Notice that funds that are infrequently marked-to-market may (private equity, hedge funds, etc.) appear to have high growth, but also have high risk of collapse because of illiquidity. Hence a more appropriate formula must read \( g = \mu - \sigma^2/2 - [L(t)]^n \), or an exponential adjustment from when an illiquid investment last blew up – the greater the time, the greater the likelihood and size of collapse, unless it is miraculously converted into a liquid asset.
6. Finally, most peer comparisons are inconsequential, as most often they compare apples to oranges (two large funds are compared because of the similar AUM, but with no regard to liabilities and objectives). Moreover, the information content with regard to outperformance because of skill is totally questionable. Muralidhar and U (1997) have demonstrated how such comparisons need to be conducted. Their analysis has substantiated the conclusion that peer rankings for short data histories had minimal information content and were probably just noise.

THE SMART APPROACH

KEY RETURN MEASURE: RETURN RELATIVE TO LIABILITIES (OR SOLVENCY RETURN)

At the highest level, CIOs must track, on an intra-year basis (even daily), the annualized growth in the surplus as the difference between the annualized return on assets minus the annualized return on liabilities. This is the true return measure for pension funds, and one can make a similar case for insurance companies; endowments and sovereign wealth funds would be benchmarked to some spending policy or the achievement of some social goal that has a target rate of return. In an ideal world, where a pension fund starts with 100 percent solvency (i.e., an asset-to-liability ratio of 100 percent), total immunization of the liabilities may be feasible as long as the asset return equals the liability return;
else one has an insufficient hedge as opposed to a “Japanese hedge”. When solvency is less than 100 percent, or the pension fund seeks to increase the buffer on solvency, then the asset return must exceed the liability return, but this comes with risk.

Adjusted for cost

Typically, CIOs are benchmarked to SAAs that include allocations to various asset classes, which are not easily and/or costlessly replicated, while the benchmark assumes constant, costless rebalancing. Therefore, the liability should be replicated with an easy-to-track, “costlessly” rebalanced portfolio of financial assets; and more important, that the assets in the SAA be so chosen that they not only have a broad representation of markets, but can also be traded in futures markets (as this is the lowest cost, most efficient way to gain transparent asset class exposure with minimal credit risk).\textsuperscript{45} This is addressed below.

\textsuperscript{45} Muralidhar (2001), Appendix to Chapter 6, had argued for such indices and even suggested the creation of a Lehman Brothers Aggregate futures contract. However, I was given to believe by a former head of fixed income research that banks had no incentive to create such a contract as it would impact profits – the greater the illiquidity and the more clients that followed this index, the greater the profit to banks. Japanese investors suffer from the same problem in respect of the Nomura BPI local bond index.
Adjusted for Risk

The typical risk measures for solvency would be:

(i) measures that relate to the volatility of the surplus (i.e., the tracking error of the excess between assets and liabilities);

(ii) drawdowns of the surplus, as this could lead to a contribution event; and

(iii) semi-moments (downside deviation, ratio of good/bad risk), etc.

Ideally, a Board should articulate a risk budget relative to the liabilities that they are delegating to the CIO, as this can help in assessing the probability of meeting some solvency target over given time horizons. In addition, one may use the same procedures that are highlighted below for adjusting for risk in the asset-only space.

In the asset-only framework of hiring and evaluating either internal staff or external managers, the $M^3$ risk-adjusted performance measure should be used. Chapter 2 has already covered the $M^2$ measure, but in principal-agent space, $M^3$ is the appropriate risk-adjusted performance measure, as it not only adjusts for all the risks, but also provides guidance on optimal portfolio construction across cash (leverage), the beta asset (the benchmark), and alpha (external manager). The key function of this measure is highlighted below in a calculation of risk-adjusted returns, and a more detailed solution is given in Appendix 3.1, which provides
some background on various risk-adjusted measures and then demonstrates how the M₃ is calculated and eclipses other measures.⁴⁶

Consider $r(CAP)$ for external fund manager 1:

$$r(CAP-1) = a^*r(1) + (1-a-b)^*r(F) + b^*r(B),$$

(3.1)

where $r(CAP)$ is the M₃ risk-adjusted portfolio return, $F$ is the risk-free rate, and $B$ is the benchmark.⁴⁷ The investors want to select $a$ and $b$, such that

$$\sigma^2_{CAP-1} = \sigma^2_B$$

and

$$TE(CAP) = TE(target).$$

(3.3)

The solution for $a$ and $b$, as described in Appendix 3.1, is:

$$a = \frac{\sigma_B^2 (1 - \rho^2_{T,B})}{\sigma_1^2 (1 - \rho^2_{1,B})} \sqrt{\frac{(1 - \rho^2_{T,B})}{(1 - \rho^2_{1,B})}}$$

(3.4)

$$b = \rho_{T,B} - \rho_{1,B} \sqrt{\frac{(1 - \rho^2_{T,B})}{(1 - \rho^2_{1,B})}}.$$  

(3.5)

### Adjusted for Skill and History (Time)

Suppose a pension fund manager has to choose between two external managers – one with a track record going back seven years and another with only a five-year track record. If the two managers generate similar returns per unit of risk, then

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⁴⁶ See Muralidhar (2000), (2001), etc. on the SHARAD measure.

⁴⁷ Here we use the terms “benchmark” and “market portfolio” interchangeably.
the bias has been to hire the one with more experience. But life is never so easy and, typically, returns and risk numbers, along with longevity of experience, are wildly different, thereby blurring the right decision. For example, is the manager with the longer record of experience preferred to the one with a shorter span, even if she (namely, the former) shows a lower annualized excess return over the benchmark? Generally, the selection favors the manager with the higher excess return, regardless of length of track record. A similar problem is encountered by investment managers who must choose between competing investment strategies, where often the availability of data (or lack thereof) determines the period over which rules can be tested. Placed in such a quandary, investors often consider dropping “excess data” to make an “apples-to-apples” comparison, but such a decision that disregards any available data is flawed, as it penalizes the manager with a longer record of experience or the strategy.

In an attempt to resolve the issue, a new measure, called the SHARAD measure (Skill, History, and Risk-ADjusted measure) is devised through the product of the confidence in skill and the $M^3$.\(^{48}\) It exploits the fact that the “$C(S)$” is a probability measure (equation A.2.4), which is dependent on the time horizon of the data series, and that the $M^3$ measure provides appropriate risk adjustment and guidance on portfolio construction and expresses risk-adjusted performance in basis points. As a result, one may regard the SHARAD measure as a probability-adjusted performance measure (or as an expected risk-adjusted measure) by simply defining it, for an active strategy 1 for a given tracking error budget, as:

$$\text{SHARAD (1)} = C(S_1) * r(CAP-1). \quad (3.6)$$

\(^{48}\) Muralidhar (2001).
The “S” measure relates to the confidence that the CAP returns are skill-based (as opposed to using raw returns), and \( C(S_1) \) is the cumulative probability of a unit normal with the standard deviation of \( S \). This revised measure now will have all the attractive properties of the \( M^3 \), yet account for time through the \( C(S) \) term in a manner consistent with the skill evaluation.\(^{49}\) For managers with identical data histories, this adjustment will not impact their rankings, but for different data histories, interesting results will be witnessed, as shown in Muralidhar (2000).

Having discussed various risk-adjusted performance measures, the rest of the chapter addresses the choice of benchmarks, as these performance measures can only be used effectively if the benchmarks are transparent, easily monitored and managed, and available at low cost.

THE CASE FOR AN INVESTIBLE LIABILITY PORTFOLIO

The principal challenge in developing an optimal policy for managing the assets-to-liabilities ratio (called the funded ratio) has probably more to do with understanding the liabilities than in developing innovative investment policies. To explore how innovative investment policies can be used to ensure that the funded ratio grows over time, a simple process by which liabilities can be understood and

\(^{49}\) A few liberties are taken here with the use of \( S \) by assuming that \( S \) is an equality rather than an inequality. In addition, the rankings need not be identical with the skill rankings, as demonstrated later.
monitored on an intra-year basis is presented. Moreover, the performance statistics by which pension funds are managed (i.e., solvency measures as opposed to asset returns) and asset managers are evaluated (i.e., $M^2$ and $M^3$ risk-adjusted performance from excess returns over benchmarks and information ratios) must be changed and this is addressed below.\textsuperscript{50}

This renewed interest in asset-liability matching has been caused mainly by the rapid decline in interest rates, which led to an increase in most pension fund liabilities on a mark-to-market basis. Unfortunately for most pension funds, this decline in rates coincided with a downturn in many stock markets as also in the performance of hedge funds and private equity investments. The falling value of assets at a time when the value of liabilities was increasing led to a dramatic drop in the ratio of assets to liabilities – something experienced earlier on in 2000, with a complete reversal of the technology boom. This ratio is often what regulators, CFOs, and members of the pension fund consider while assessing whether a pension plan is “safe” or solvent. Further, new accounting standards imply that pension fund losses can affect the corporate pension fund sponsor. As a result, many pension plans worldwide are adjusting their investment and hedging strategies to reduce the impact of a declining and volatile funded ratio.

Pension funds often find it difficult to elucidate to their asset managers the desired approach and implementation of LDI strategies which would enable the managers to design optimal products. Being poorly served by way of innovative products, the industry depends on the CIOs to be the key innovators. But the

\textsuperscript{50} Thanks to David Deutsch for this point.
main problem that pension fund managers encounter is in setting an appropriate investible benchmark that reflects the liabilities.

The liability is the projected pension cash flow that needs to be serviced and hence is the basis for all investment decisions. In other words, the investment plan needs to be designed to meet the objective of servicing liabilities, at the lowest possible cost and with minimal contribution volatility. Several recommendations for protecting pension fund solvency through the immunization of liabilities have been published. These recommendations range from the approach of the Boots Pension fund, which converted the entire portfolio of assets into fixed income assets (since revised to include a small allocation to non-fixed income assets), to a complete abandoning of the strategic asset allocation policy in favor of a totally tactical policy, to duration extension combined with ‘portable alpha’.

TRADITIONAL APPROACH

The traditional approach has been to get a simple simulation from the actuaries, whose output is often no more than a series of quasi-deterministic, once-a-year cash flow estimates. Figure 3.1 charts a typical projected cash flow for a European

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51 Again, thanks to David Deutsch for this clarification. Cost can be viewed from two perspectives: (i) the lowest possible contribution rate; and (ii) the lowest cost of managing the investment operation. Here, we use both perspectives.
The hump-shaped profile is common across all major developed countries, indicating the aging of the population.

![Figure 3.1. Typical projected pension fund cash flow.](image)

Typically, these simple cash flow projections are introduced into an ALM model, and an attempt is made to develop an SAA to reduce ALM risks. Pension funds (i.e., CIOs and Board) deal with many issues vis-à-vis these projections. The simplest criticism is attributed to Mulvey (1994) who highlights that the use of deterministic projections of liabilities is not correct, as liabilities are influenced by various inflation and interest-rate projections. However, the bigger questions, as highlighted in Muralidhar and van Stuijvenberg (2006), are:

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52 Thanks to Roland van den Brink of Bedrijfstakpensioenfonds Metaelektro in the Netherlands (PME) for this data.
• How are assets to be managed against this set of cash flows? To effectively manage a pension fund, one needs to measure and monitor these nominal liabilities.

• How does one measure and monitor liabilities relevant to investment decisions that need to be made? Previously, an annual assessment was sufficient, but in today’s world a more frequent valuation is needed, especially if one wants to manage the funding ratio effectively on an intra-year basis.

• In turn, such a schedule would lead to the challenge of translating the above cash flows to quoted market instruments. The standard approach to develop a benchmark is relatively simple (see below), but it is more difficult to implement in practice. It compels managers to either accept a high tracking error, or incur a very costly implementation.

Figure 3.1 presents a typical example of projected pension benefit cash flows from actuaries. The analysis is restricted to the nominal liabilities for ease of exposition. Effectively, each future cash flow is nothing but a zero coupon bond with a given maturity. From this viewpoint, the manager needs to invest in such bonds in the appropriate notional amount. For example, if the estimated cash flow due in 2016 is €750,000, then the manager needs to find a zero coupon bond with that maturity and invest the relevant amount to earn a payout equal to €750,000. The relevant amount to invest today to achieve such a payout in December 2016 would be determined by the zero coupon bond rate for that maturity.

Using the cash flows charted in Figure 3.1 and logged in Table 3.1, one can conclude that the present value of liabilities is €15 billion with a duration of 15.14
years. However, the snag in this approach is that such pure instruments do not exist; hence either a theoretical zero coupon portfolio may be constructed but not implemented, or an alternative portfolio needs to be constructed from a zero coupon as well as coupon-bearing bonds (or by boot-strapping the zero coupon curve implied by these bonds).

It is not unmanageable to construct such a portfolio for any set of liability cash flows from the universe of government bonds in any markets, though inter/extrapolation techniques have to be used for the 30+ year cash flows. The theoretical bond portfolio can be marked-to-market daily, thereby giving clients an effective estimate of their liability performance intra-year. The bigger problem is that with many cash flows, over multiple years and of moderate amounts, the traditional liability benchmark involves small allocations to multiple securities, making the benchmark unwieldy and therefore difficult for the average board member to grasp. Managing a tailor-made portfolio of 50 zeros does not seem to exceed current computing power. The crucial drawback is that the zero coupon bond approach does not lead to clean and transparent pricing and would also be costly to implement. Furthermore, the obtained benchmark, relying on the valuation of (zero coupon) bonds, may contain a credit spread element (there being no unique Euro zone government yield curve, because different issuers have marginally different credit qualities) and is hence less objective than standard benchmarks.⁵³

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⁵³ Tim Barrett raises the interesting idea of breaking out the liability into two components - retired and actives – and managing the pools accordingly. All concepts presented in the following pages would still apply to this paradigm.
INNOVATIVE APPROACH

A simple, stable, and accurate benchmark to mimic liabilities based on daily available swap indices is described,\textsuperscript{54} and the work done at the PME Pension Fund is used to make the case. The only input needed is the projected annual liability cash flows. For the issues highlighted above, PME adopted a different approach from the zero coupon approach, using instead the most liquid fixed income markets instruments: swaps. The swap curve is the pricing benchmark in the euro market and therefore the best starting point for index construction. The plain vanilla (coupon-bearing) interest rate swaps market offers excellent benchmarks. For instance, each of Lehman/Barclays Bellwether indices have a long track record. If the above cash flows could be replicated by using a set of these indices, an objective and investible benchmark could be achieved. Under the swap method, an optimization technique is used to determine optimal weights to a portfolio of Lehman/Barclays indices such that this swap portfolio mimics the performance of liabilities. In such a situation, a chosen set of indices is used to find an optimal mix and, typically, the swaps selected are of the standard, plain vanilla coupon-bearing variety and maturity (i.e., one-year, two-year, five-year, 10-year, and 20-year). To determine the weight of each Lehman index in the liability benchmark, one simply needs to use historical yield curve data and find the portfolio that gives sufficiently low tracking error relative to the valuation of

\textsuperscript{54} Previously offered by Lehman Brothers but now offered by Barclays. Similar indices can be constructed for U.S. or other developed market clients.
liabilities. In the case of pension cash flows modeled in Figure 3.1, optimal weights to the various indices are as shown in Table 3.1.

### TABLE 3.1 Modeling liabilities as a portfolio of swaps

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Optimal Weights</th>
<th>Optimal Notional</th>
</tr>
</thead>
<tbody>
<tr>
<td>012M SWAP</td>
<td>-6.29%</td>
<td>€ -946,585,328</td>
</tr>
<tr>
<td>024M SWAP</td>
<td>7.82%</td>
<td>€ 1,176,410,795</td>
</tr>
<tr>
<td>060M SWAP</td>
<td>3.55%</td>
<td>€ 534,557,087</td>
</tr>
<tr>
<td>120M SWAP</td>
<td>16.60%</td>
<td>€ 2,496,188,497</td>
</tr>
<tr>
<td>240M SWAP</td>
<td>23.10%</td>
<td>€ 3,473,746,096</td>
</tr>
<tr>
<td>360M SWAP</td>
<td>27.29%</td>
<td>€ 4,103,839,938</td>
</tr>
<tr>
<td>480M SWAP</td>
<td>18.98%</td>
<td>€ 2,854,444,211</td>
</tr>
<tr>
<td>600M SWAP</td>
<td>6.92%</td>
<td>€ 1,041,095,121</td>
</tr>
<tr>
<td></td>
<td>Tracking Error Daily</td>
<td>0.019%</td>
</tr>
<tr>
<td></td>
<td>Tracking Error Annualized</td>
<td>0.303%</td>
</tr>
<tr>
<td></td>
<td>R-Squared</td>
<td>99.83%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Duration Liabilities</th>
<th>Duration Mimic Portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15.14</td>
<td>15.00</td>
</tr>
</tbody>
</table>

First, this simple portfolio of some key liquid instruments lends itself to acceptance by a Board. The portfolio of swap indices has an annualized tracking error of 0.30 percent relative to the liabilities over the historical simulation period. An alternative check is to compare the durations of both portfolios – and, as shown in Table 3.1, the difference is minimal. It may be argued that it is better to optimize the weights over some future simulations, using a Monte Carlo technique, but such a proposal only changes the method, not the approach to estimating an appropriate liability benchmark.
A few other caveats bear mention. Sometimes such an optimization can provide negative weights to certain swap maturities (e.g., the 12-month/one-year recommended allocation), which sophisticated clients can see is either a short position or a forward starting swap. Another issue with portfolios using swap indices is that credit risk is included; hence, as in the recent market meltdown, credit spreads can widen, with the unintended consequence of making the current value of liabilities appear lower than they actually are. In the United States, the use of a 15+ year discount rate (inclusive of a credit spread) in the accounting treatment of liabilities led to a substantial reduction in “estimated” liabilities because credit spreads “blew out” during the 2008 crisis. The economic liability was unchanged, but the accounting liability was dramatically reduced. Such constraints notwithstanding, one can now track, on an intra-year basis (even daily), the annualized growth in the surplus as the difference between the annualized return on assets minus the annualized return on liabilities. This is the true return measure for pension funds, and risk measures must relate to the volatility, drawdown, and semi-moments of this yardstick. This is explained in more detail in Muralidhar (2001), Chapter 4.

An additional benefit of using the swap-based approach embedded in the ILP is that negligible capital is required to hedge liabilities. Many pension funds mandate setting aside capital for hedging liabilities (through fixed-income investments) or return generation (through equity or alternative investments). Then, because they suspect the imposition of a leverage constraint (i.e., the weights allocated to these instruments have to add up to 100 percent), they react as if the objectives were beset with contradictions. Of course, this is not the case. The real concern should be overall funding risk, and the ability to effectively
hedge liabilities with derivatives is an attractive proposition that frees up capital for return generation. Leverage for risk reduction is not as insidious as the reputation it has earned because of bad decisions by asset managers.

This section demonstrated how innovative pension plans can convert actuarial projections of pension benefits into an appropriate investible benchmark, allowing plan sponsors a better measure of the performance of their liabilities (and assets) on an intra-year basis and a transparent, simple index for Boards to track. This ILP will be used in Chapters 5, 6, and 8 to demonstrate effective implementation of LDI strategies. In addition, new solvency performance and risk measures were highlighted, and the goal will be to design strategies to ensure the effective achievement of these objectives within tolerable levels of the risk measures. The discussion now turns to how beta assets should be selected prior to a discussion of how they should be managed effectively (Chapters 4 and 6).

**CREATING EFFECTIVE, LIQUID, LOW-COST, TRANSPARENT ASSET BENCHMARKS**

Muralidhar (2001) treated low-cost benchmarks in a tangential fashion, appending its discussion to a chapter on the effective use of derivatives in managing pension funds. However, the recent market turmoil has shown up this issue as probably more critical than the SAA itself, as poorly chosen benchmarks cause CIOs to take unintended tracking error, preventing a dynamic managing and hedging of beta.
The most pressing problem that irked pension fund managers is that the indices used in the SAA, to which pension fund managers around the world were benchmarked, were not easy to replicate by using futures. For example, Lehman/Barclays Aggregate, MSCI EAFE, MSCI World, MSCI Kokusai, Nomura BPI, etc. are common benchmarks but generate unnecessary tracking error in replication through futures, making it problematic for pension funds to make low-cost, effective shifts if the assets were not favored or if the view-neutral or rebalancing shifts were needed to be made periodically. The rationale for the approach of benchmarking to the more complex indices was that most investment managers manage assets relative to these standard benchmarks and that these indices covered the broader investment spectrum of the sectors on which they focused.

Smart pension funds should use only indices on which liquid futures exist, as these capture the broad asset class performance and volatility (typically modeled in the ALM studies). Though such a practice may exclude certain market segments, such as credit in bond indices today, this tendency may be attributed more to badly designed market instruments than to an inability to provide this product. It may be confidently assumed that investment banks would be ever willing to create a futures-based index on credit if CalPERS, CalSTRS, and a few other major corporate pension funds requested this. That this has not been the case is probably because of the inadequate numbers of CIOs making such requests, which has left the field clear for investment banks to absorb the profit from creating such exposure through illiquid, over-the-counter swaps. On the other hand, the existence of an S&P 500 equity index, and even an MSCI EAFE and

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55 See Muralidhar (2001), Chapter 6, Appendix.
MSCI Emerging market futures index, demonstrates that it is trivial for banks to create a futures contract on the Lehman/Barclays Aggregate index or the Citigroup World Government Bond Index. It is time that CIOs requested such products and banks became pro-active in providing what institutions need, instead of capturing disproportionate rents in exploiting an incomplete market.

It is obvious that the performance of these futures-based indices is not biased in any way towards underperforming the regular indices on an *ex-ante* or *ex-post* basis. Table 3.2 provides basic statistics on a futures-based index for international investments (i.e., composed of a weighted average of multiple country equity benchmarks) and compares it to the actual performance of the MSCI EAFE cash index. The latter is a typical index used by U.S. pension funds to benchmark international investments. Clearly, these indices are virtually indistinguishable from one another, but the futures index composite (i) is more liquid than an MSCI or alternative vendor-based index; (ii) is based on the primary equity indices traded in every country; (iii) has maximum transparency and visibility; and (iv) has the lowest cost to trade.

With liquid indices represented in the SAA, and the liabilities captured as a portfolio of swaps, an increase in the correlation of assets to liabilities through dynamic management of the SAA and liability hedging becomes much easier to implement. Now, liabilities are hedged when it is optimal to do so (Chapters 5 and 6), and many more decisions are available to manage the funds (i.e., all the rebalancing in the SAA), as shown in Chapter 7.

The actual implementation of the transactions, which can be delegated to a futures/derivatives execution agent, will be extremely cost-effective, given the
choice of benchmarks that have liquidity. The use of futures to replicate broad asset class exposure is addressed again in Chapter 9 to show how a simple change in implementation can save participants in DC plans as much as 50 basis points a year – a significant saving that leads to a much higher pension.

**TABLE 3.2 Monthly statistics for MSCI EAFE and a futures-replicating basket (06/00- 02/09)**

<table>
<thead>
<tr>
<th></th>
<th>EAFE Futures Basket</th>
<th>EAFE USD (BMK)</th>
<th>Futures Basket - BMK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>-0.29%</td>
<td>-0.36%</td>
<td>0.065%</td>
</tr>
<tr>
<td><strong>Standard Error</strong></td>
<td>0.49%</td>
<td>0.50%</td>
<td>-0.011%</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>0.60%</td>
<td>0.41%</td>
<td>0.194%</td>
</tr>
<tr>
<td><strong>Standard Deviation</strong></td>
<td>5.03%</td>
<td>5.15%</td>
<td>-0.111%</td>
</tr>
<tr>
<td><strong>Sample Variance</strong></td>
<td>0.25%</td>
<td>0.26%</td>
<td>-0.011%</td>
</tr>
<tr>
<td><strong>Kurtosis</strong></td>
<td>1.72</td>
<td>1.81</td>
<td>-0.10</td>
</tr>
<tr>
<td><strong>Skewness</strong></td>
<td>-0.85</td>
<td>-0.97</td>
<td>0.12</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>31.86%</td>
<td>31.92%</td>
<td>-0.059%</td>
</tr>
<tr>
<td><strong>Minimum</strong></td>
<td>-20.15%</td>
<td>-21.00%</td>
<td>0.858%</td>
</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>11.72%</td>
<td>10.92%</td>
<td>0.798%</td>
</tr>
<tr>
<td><strong>Count</strong></td>
<td>106</td>
<td>106</td>
<td></td>
</tr>
</tbody>
</table>

**SUMMARY**

56 Thanks to Brian Baker for this table.
This chapter showed how the focus on asset returns masks both the key norm of a CIO’s performance and the ineffectiveness of peer comparisons. In addition, it highlighted the method for calculating risk-adjusted ($M^2$ and $M^3$) and skill-adjusted (SHARAD) performance. Finally, the discussion presented a new approach to benchmarking and to monitoring assets and liabilities – an approach that entails the use of futures and swaps. Once assets and liabilities are replicated by means of these liquid instruments, then CIOs can easily and effectively (i.e., low cost) implement their desired portfolio changes. With clear, liquid, and transparent benchmarks, and clearly articulated solvency goals and risk measures, the CIO is now empowered to manage the fund in the most effective manner, and subsequent chapters demonstrate how SMART management of assets and liabilities leads to improved solvency and a lowering of ALM risks.

APPENDIX 3.1 - Risk-Adjusted Performance

Practitioners and academics recognize that performance unadjusted for risk is not meaningful. Of the various risk measures used to adjust performance, the two most commonly used measures are the Sharpe ratio and the information ratio (also known as the differential Sharpe ratio). Newer measures have been proposed that are variations of these measures. This appendix develops and evaluates a series of measures that are inter-related.

57 Sharpe (1994).
THE SHARPE RATIO AND THE INFORMATION RATIO

The Sharpe ratio effectively adjusts performance above the risk-free rate by the volatility of the excess returns (where excess return is the portfolio return minus the risk-free rate), and the information ratio (A.2.3) adjusts the excess of benchmark performance by the volatility of the excess return series. Logue and Rader (1997) suggest that the Sharpe ratio is the best way to adjust for risk. The information ratio is a variation of the Sharpe and is based on excess returns and the volatility of the excess returns.

THE M² MEASURE

Modigliani and Modigliani (1997) make an important contribution by showing that the portfolio and the benchmark must have the same risk for a comparison in terms of basis points of risk-adjusted performance. They propose that the portfolio be leveraged or deleveraged, using the risk-free asset. If $B$ is the benchmark being compared to portfolio 1, the leverage factor $d$ is defined as follows:

$$ d = \frac{\sigma_B}{\sigma_1}. $$

(A.3.1)

It creates a new portfolio, called the risk-adjusted portfolio (RAP), whose return $r(\text{RAP})$ is equal to the leverage factor multiplied by the original return plus one minus the leverage factor multiplied by the risk-free rate. Thus, if portfolio $F$ is the
riskless asset with zero standard deviation and is uncorrelated with other portfolios, the risk-adjusted return is:

\[ r(RAP) = d \times r(\text{actual portfolio}) + (1-d) r(F), \]  

(A.3.2)

where

\[ \sigma_{RAP} = \sigma_B. \]  

(A.3.3)

The correlation of the original portfolio to the benchmark is identical to the correlation of the RAP to the benchmark, as “leverage or deleverage” (using the risk-free rate) does not change the correlation characteristics. The correlation is normally less than unity. If the correlation is 1, it could lead to a riskless arbitrage. The chart for the \( M^2 \) measure is provided as Figure 2.1 in Chapter 2.

The Modigliani analysis suggests that this \( M^2 \) adjustment allows for a comparison of “apples to apples”, namely, the returns from the benchmark and the RAP have the same volatility. It shows that making this adjustment can reverse the peer rankings of mutual funds and managers. The rankings are shown to be identical when using the Sharpe ratio measure, as the principle is similar. The \( M^2 \) measure, however, was preferred, as it expresses risk-adjusted performance in terms of basis points of outperformance and provides guidance on assets allocated to the external manager (allocation of \( d \)) and the risk-free asset (allocation of \( 1-d \)). The Modiglianis also discard the use of the information ratio, as it could lead to incorrect decisions. For example, portfolios could have a negative information ratio, but would have a risk-adjusted performance greater than the benchmark. Graham and Harvey (1997) propose a variation of this method, assuming the
riskless asset need not be an asset uncorrelated with other assets. This leads only to different allocations across funds rather than suggesting a new approach.

The $M^2$ adjustment makes the comparison in terms of basis points of outperformance by ensuring that all portfolios have the same variance as the benchmark. The only major shortcoming is that two funds, normalized for the benchmark volatility, could have different correlations with the benchmarks and hence different tracking errors. This is also shown in Figure 2.2. The tracking error is important to investors, especially institutional investors, because it provides a measure of the variability of a manager’s returns around the benchmark. Investors would prefer, all else being equal, funds with a lower tracking error (and hence greater predictability in returns). Hence these rankings could provide investors with incorrect information about the relative risk-adjusted performance of funds.

THE $M^3$ METHODOLOGY – ADJUSTING FOR DIFFERENCES IN CORRELATIONS

An investor has to rely on available data to make projections for the future. Assuming historical distributions are preserved in the future, one has to synthesize the three-dimensional problem of a comparison of return, standard deviations, and correlations into a simple two-dimensional space of return and risk.\(^{58}\) In mean-variance space, the riskless asset is portfolio $F$ (with returns $r(F)$),

---

\(^{58}\) These are heroic assumptions, to say the least. Some forecast needs to be made on expected outperformance, variability of performance to achieve this outperformance, and correlations between portfolio and benchmark returns. Historical performance is one way of making
and it can be used to leverage or deleverage the desired mutual fund/manager. In tracking error space, the only portfolio with zero tracking error is the benchmark portfolio, as it is perfectly correlated with itself (where $\rho = 1$, $TE = 0$, as $\sigma_B = \sigma_I$). Therefore, combining active mutual funds/managers with passive benchmarks and the riskless asset can be used to alter the overall portfolio’s standard deviation and its correlation with the benchmark.

To create measures of correlation-adjusted performance, the investor needs to invest in the active strategy, the riskless asset, and benchmark to ensure: (i) the volatility of this composite is equal to that of the benchmark (Modigliani and Modigliani 1997); and (ii) the tracking error of this composite is equal to the target tracking error (Muralidhar 2000). The $M^3$ measure recognizes that the investor has to consider basis points of risk-adjusted performance after ensuring that correlations of various funds versus the benchmark are also equal.

**THE $M^3$ MODEL**

Hammond (1997) states that, to establish performance-related thresholds for managers, the investor must set a target tracking error and compare funds to the target. A similar approach is proposed by Litterman, Longerstaey, Rosengarten, and Winkelman (2001). forecasts, but the $M^3$ measure is independent of the forecasting technique. In addition, one must assume that markets are inefficient to conduct such analyses.
Assume that the investor is willing to tolerate a certain target annualized tracking error around the benchmark, say, 300 bps \((TE(\text{target}))\).\(^{59}\) The investor essentially wants to earn the highest risk-adjusted alpha for a given tracking error and variance of the portfolio. Now define \(a, b,\) and \((1-a-b)\) as the proportions invested in the mutual fund, the benchmark, and the riskless asset, respectively. Let \(\text{CAP}\) be the correlation adjusted portfolio. Then the returns of a \(\text{CAP}\) are:

\[
\begin{align*}
    r(\text{CAP}) &= a*r(1) + b*r(B) + (1-a-b)*r(F).
\end{align*}
\] (A.3.4a)

As is apparent, this is an extension of the \(M^2\) measure. Further, the investor must hold appropriate proportions of each asset to ensure that the final portfolio has the target tracking error and the standard deviation of the benchmark. For a specific mutual fund, say, mutual fund/active strategy, say 1, with a risk-adjusted return \(r(\text{CAP}\)-1\)), equation (A.3.4a) can be re-written as:

\[
\begin{align*}
    r(\text{CAP}\)-1\) &= a*r(1) + (1-a-b)*r(F) + b*r(B),
\end{align*}
\] (A.3.4b)

where the coefficients of each portfolio represent the optimal weight of that specific portfolio to ensure complete risk adjustment. In addition, from the constraint on tracking error, a unique target correlation is apparent between the \(\text{CAP}\) and benchmark \(B\). As demonstrated in Muralidhar (2000), this target correlation of the portfolio with that of the benchmark \((\rho_{T,B})\) is given by the equation for tracking error when \(\sigma_B = \sigma_1\); namely,

\[
\begin{align*}
    \rho_{T,B} &= 1 - \frac{TE(\text{target})^2}{2*\sigma_B^2} \\
\end{align*}
\] (A.3.5)

\(^{59}\) This measure is independent of the level of tracking error, and hence is applicable across all tracking error targets.
By maximizing the \( r(CAP) \) subject to the condition that the variance be identical to the benchmark, and its correlation to the benchmark equal to the target correlation, for mutual fund 1,

\[
a = + \sqrt{\frac{\sigma_B^2 (1 - \rho_{T,B}^2)}{\sigma_B^2 (1 - \rho_{1,B}^2)}} = \frac{\sigma_B}{\sigma_1} \sqrt{\frac{1 - \rho_{T,B}^2}{1 - \rho_{1,B}^2}} \quad (A.3.6)
\]

\[
b = \rho_{T,B} - a \times \frac{\sigma_1}{\sigma_B} \rho_{1,B} = \rho_{T,B} - \rho_{1,B} \times \frac{1 - \rho_{T,B}^2}{1 - \rho_{1,B}^2} \quad (A.3.7)
\]

The details of these calculations are provided in Muralidhar (2000). The allocation to the benchmark is independent of variances and is only a function of the correlation terms. While \( b \) and \((1-a-b)\) may be greater than or less than zero (negative coefficients being equivalent to shorting the futures contract relating to the benchmark and borrowing at the risk-free rate), \( a \) is constrained to being positive, as it is not currently possible to short mutual funds.\(^60\) However, with active management strategies, \( a \) can be positive and negative.

This method is preferred to the M\(^2\) as it: (i) expresses risk-adjusted performance in basis points; (ii) gives advice on portfolio construction – specifically between the risk-free asset, the benchmark (passive investing), and the active portfolio (active management); and (iii) provides rankings that are identical with the rankings based on skill for equal time horizons. This measure also has the

\(^60\) This may change with the development of exchange-traded funds (ETFs) on active portfolios. In some cases, it may be difficult to short the benchmark as well, and then \( b \) will need to be constrained to being greater than or equal to zero. This would not change the analysis of the measure. Generally, most benchmarks can be shorted through either their futures contract or a swap.
attractive property of keeping a constant annualized tracking error target over all time horizons. However, the $M^3$ falls short when two funds have different time periods of data.
The Case for SMART Management of Portfolios

“To hell with the public! I’m here to represent the people.” A New Jersey senator

BACKGROUND

The year 2008 was a watershed for the fund management industry, as it revealed the flaws in past portfolio management theory and practice, and difficult performance even trickled over into the first quarter of 2009. Pensions and Investments, a leading pension publication in the United States reports, “The median plan in the BNY Mellon U.S. Master Trust Universe returned -6.07 percent in the first quarter, up 7.03 percentage points from the fourth quarter of 2008 but still the sixth straight quarter of negative returns. Ninety-seven percent of plans in the universe posted negative returns for the first quarter.” Sadly, in the United States, this was on the back of a stormy period for pension solvency as, “[F]or information years ending in 2007, PBGC received filings for 119 controlled groups

61 Petras (2001), page 136, quoting a New Jersey senator.
covering 313 plans. These plans reported total liabilities of $253.3 billion and total underfunding of $67.2 billion (both measured on a termination basis).”\(^\text{63}\)

Not only did the solvency of pension funds globally decline, but this unforeseen downturn in solvency was coupled with a severe cash crunch, as illiquid assets demonstrated that liquidity can dry up and cause a plethora of problems. Many pension funds (and endowments and foundations in the United States) that had invested in private equity funds on the assumption that capital calls could be met by maturing investments found that the existing investments could not be liquidated while capital calls still needed to be met. In an attempt to generate cash, clients could not exit hedge funds (which instituted gates\(^\text{64}\) at the worst possible moment), could not sell out of fixed income (which had ostensibly been maintained for their liquidity), and therefore sold the most liquid asset – equities – causing equity markets to fall further. In addition, many Dutch pension plans implemented static, fully currency-hedged international investments, at the suggestion of the DnB and the advice of ALM consultants, and had to liquidate investments to meet cash margin calls from hedges that impaired performance from a weakening Euro in 2008-2009. To compound problems, the differences in (accounting) valuation cycles between public and alternative assets caused havoc in portfolios as alternatives grew to a disproportionate percentage of typical portfolio, necessitating even more drastic rebalancing measures. \textit{In short, the economic meltdown of 2008 proved that static portfolio management approaches...}

\(^{63}\) Testimony of Charles E.F. Millard, Director Pension Benefit Guaranty Corporation before the Committee on Education and Labor United States House of Representatives, October 2008.

\(^{64}\) See Muralidhar (2009b).
to dynamic markets is a prescription for disaster, especially when the perfect storm hits.

**DYNAMISM – OLD WINE FINALLY UNCORKED**

*Nobody goes there anymore. It is too crowded. Yogi Berra*  

The experiences of the U.S., Dutch, and Japanese funds lead one to conclude that the entire pension fund management paradigm must be modified to deal with the dynamism of markets. One may also assume that the experiences of other major markets such as Australia, Asia (Singapore, Hong Kong, and Korea), Canada, the Middle East, and the UK, with large pools of capital in institutional funds, are similarly fraught with problems. Smart clients globally are asking key questions including: (a) Does it make sense to have a static SAA? (b) Should there be a long-term and a medium-term SAA? (c) How does one think about the rebalancing decision? (d) How does one think about the currency hedging decision? (e) How does one account for illiquidity in terms of return and risk? And (f) how does one rebalance portfolios that are allocated to illiquid assets?  

Now is possibly the most appropriate time to implement any “new” approaches, as there is a lot of soul-searching globally; regrettably, the focus on exotic hedge funds and alternatives had distracted the industry over the past three years away  

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65 See Petras (2001), page 143, quoting Yogi Berra as to why he did not want to go to a particular restaurant for dinner.  

66 Tai Tee Chia deserves the credit for formalizing the debate into a much simpler set to questions posed here.
from simple pension fund ALM issues using liquid assets. None of what follows is entirely new, and one can gain mileage from the work of Barrett (2006), Brock (2005), Hodgson (2006), Mulvey (1988), Mulvey (1994), Arikawa et al (2005), Muralidhar (2007), and Muralidhar and Muralidhar (2009) in presenting the SMART paradigm - SMART in our context standing for Systematic Management of Assets using a Rule-based Technique. The same processes and techniques can be applied by other institutional investors as well.

Brock (2005) provides the most succinct explanation of this approach, namely, that the paradigm of Optimal Portfolios needs to be substituted with Optimal Strategies, or what he calls Passive Beta Management. “A strategy is defined as a rule that specifies, for an investor of a given risk attitude, the best portfolio to hold in any particular ‘state’. If there are 12 different states, then there will be 12 state-dependent optimal portfolios.” Mulvey (1988) provides an alternative explanation, but a similar focus, namely, “At each stage, the investor must attempt to maintain his long-range goals, while simultaneously adjusting to short-run market swings. This…takes into account the dynamic nature of pension plan investment decisions.” What is amazing is that Prof. Mulvey’s observation was made 20 years ago, but the market is only just beginning to understand its relevance. The next section explains why such an approach is important, especially in the context of the assumptions on correlations that have been made by pension funds or consultants in setting up the SAA and rebalancing policies for funds.

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67 Mulvey (1994) refers to SMART as Surplus Management and Risk Technology which could also be applied in this context.
While there has been considerable introspection on expected return assumptions and volatility, relatively little attention has been paid to the correlation statistic.\(^{68}\) Swensen (2009) devotes some attention to the topic of correlations, demonstrating how historical correlations may not be appropriate for asset allocation studies and discussing how “the Investments Office adjusted the correlation matrix to reflect the staff’s informed judgments regarding expected correlations.”\(^{69}\) In effect, the Yale Investment Office is taking a static correlation bet. Approaches such as the Black-Litterman model have gained much credence in promoting an investor’s implied market views,\(^{70}\) so much so that several asset management firms have built investment processes on the Black-Litterman model without questioning a major assumption: \(^{71}\) namely, that, in trying to reverse-engineer asset allocation decisions, the Black-Litterman model ignores the fact that the investor may be taking a bet on volatilities and correlation – the simplest reason for doing so being that it is practically impossible to solve for these implied parameters. That this pertinent factor has been swept under the carpet, very gently, has very definitely harmed the investor’s interests.

\(^{68}\) For the growing literature on the impact of correlations on the diversity of portfolios – see Fernholz (2005) and Hight (2009).
\(^{69}\) Page 119.
\(^{70}\) See Black and Litterman (1992) and (1999). See also Lee (2000) and http://www.blacklitterman.org/.
\(^{71}\) Bob Litterman had indicated, during a job interview that the author had with him in 1999, that it is easier to forecast volatilities – an assumption that can be contested after 2008 – and hence the focus solely on return implied views. But holding correlations and volatilities constant can be shown to be severely flawed, as often investment processes unwittingly take on volatility risk. See Muralidhar and Neelakandan (2002).
Ignore the fact that correlations across two assets may be dynamic (Swensen 2009) and focus on a much simpler problem, namely, that of understanding the implied bet in choosing a correlation value. This very blunt statistic masks the relationship of assets to various factors (i.e., a low correlation between stocks and bonds is caused by the fact that they respond differently to oil, interest rates, etc.). Therefore, in setting an SAA and assuming specific correlations (and expected returns), pension funds are making a bet on these economic relationships, and to neglect to exploit them in the implementation and management of a portfolio is inconsistent. To put it simply, the same daunting and bewildering array of factors that Swenson decries for market timing impact asset returns and correlations.

For example, a client provided us with data on two currency managers labeled Manager 117 and Manager 102. A historical correlation analysis suggested that the correlation of the manager returns was 0.06, and hence a good case could be made to include the two of them in a portfolio. But the questions that arise here are: what caused this low correlation, and could it be explained by evaluating the managers’ performance relative to some market factors?

A series of factor-based regressions were run using factors known to influence the performance of currency managers, such as interest rate differentials, yield curves, implied volatilities, commodity prices, and economic data. The resulting analysis provided valuable insight into why these managers performed differentially over time. Figure 4.1 highlights the cumulative growth of a dollar invested in Manager 102 (yellow line) and Manager 117 (red line), along with the EUR/USD Option Implied Volatility from October 2002 to January 2007. What is

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72 See Chapter 8 for a more detailed list of these factors.
clear from the figure – and this was evident in the factor analysis too – is that Manager 117’s performance showed positive impact with an increase in the EUR/USD Option Implied Volatility (lagged for the purpose of the factor analysis), whereas Manager 102’s performance showed negative impact, and vice versa. With yield curves, a similar sensitivity was revealed. While no prior information was available on these managers’ styles, it was obvious that good performance when volatility rose suggested a trend-based portfolio management style, whereas the opposite was a short volatility position (both of which are profitable in the long run, but over different market environments).73

Therefore, over a long cycle, while the two managers may be uncorrelated, an understanding of the impact on manager performance as various market parameters evolve has important implications for portfolio management. A cursory glance at the chart would suggest that, rather than a static Markowitz-type optimization of portfolio weights, a sensible investor would have chosen to tilt the portfolio in favor of Manager 102 when volatility started to decline in November 2004 and thus would have done better than the static mix.74

73 See Muralidhar and Neelakandan (2002).
74 Alternatively, as shown in Muralidhar and Neelakandan (2002), new products based on options, could have been used as an overlay on the managers to exploit these relationships. Credit to Roger Paschke for implementing such a unique options overlay-on-an-overlay.
Figure 4.1. Explaining manager correlations using market factors

Therefore, to choose two assets (individual securities, asset classes, managers, etc.) on the basis of some historical or forecasted correlation is just the starting point of the process. To be consistent, a factor analysis should be used first to analyze the factor sensitivity bets implied in the correlation assumption and then to manage the portfolio dynamically as the factors evolve over time.

MOVING TO THE SMART PARADIGM

Historically, the approach to asset allocation has been very static – and SEI (2009) confirms this assertion. In this section, previous practice with regard to static SAAs and static rebalancing is reviewed, and an innovative approach that incorporates the work of Arikawa et al (2005), Brock (2005), Mulvey (1994), Muralidhar (2001), etc is proposed.
TRADITIONAL APPROACH

The SAA was considered the lynchpin of the investment portfolio and was conducted over a long-term horizon (usually with a 5- to 10-year perspective). As a result, the SAA was relatively static and not modified either intra-year or frequently across many years. Some exceptions to this were a few research studies that suggested that adjusting the SAA on an annual basis relative to the funded status would improve solvency risk, and this is addressed in the next chapter. Simple examples of these SMART approaches included basic formulae such as:

\[
\text{Allocation to Equity} = 20\% + 0.4 \times \text{Funded Status}.^{75}
\]

Therefore, for a starting solvency of 100 percent, the initial allocation to equity would be 60 percent; but should the funded status rise to 110 percent, the fund’s risk-taking ability would increase, thereby permitting a higher investment in risky assets (to 64 percent). This is referred to as “View-Neutral Dynamic SAA”, as these rules were based not on the market perspective but rather purely on the fund’s solvency. These rules were easily simulated in typical ALM models, assumed to be made just once a year at the year’s commencement, and can generally be shown to be no less effective than the oft-applied static SAA approaches from the perspective of solvency and contribution policy. According to Investments and Pensions Europe, the ABN AMRO Pension Fund applied such rules on a more frequent basis in 2008 with distinctive success, managing to retain solvency at

\[\text{See Muralidhar (2001), Chapter 4; Dert (1998); and Boender et al (2006).}^{75}\]
about 105 percent when most other pension funds in the Netherlands suffered serious setbacks.\textsuperscript{76} This is one of the simplest forms of SMARTs. Yet utilization of this technique has been more the exception than the rule, as it was not given credence even though research in 1997 had shown its efficacy (Muralidhar 2001). However, ABN AMRO’s positive implementation last year vindicates its advantages and hence the chapter includes the case study. In short, this chapter advocates a dynamic SAA, where the SAA evolves over time, using a View-Neutral and View-based SMART Process. (This is discussed in greater detail in Chapter 5.)

**Rebalancing:**

The next issue that plan sponsors have to deal with after setting the long-term SAA is how to rebalance the portfolio as the daily market movement shifts the actual allocation away from the SAA. Many consultants and pension fund managers adopt a rebalancing policy that typically involves returning the asset allocation to the target allocation/SAA at calendar intervals (e.g., monthly, quarterly, or annually). Alternatively, portfolio managers may use a “range-based” approach whereby the trigger points or ranges are typically 3-5 percent from the target, based on the volatility of asset classes. Lim (2008) and Lim (2009) provide good examples of advice given to retail investors on how to rebalance, based on the practices of institutional investors. In fact, the well-known CIO of the Yale Endowment, David Swensen, is on record in multiple forums on the value of this

\textsuperscript{76} See Investments and Pensions Europe, March 2009, page 34.
programmatic rebalancing for institutional and retail investors. To quote extensively from Swensen (2005), “Rebalancing involves taking action to ensure that the current portfolio characteristics match as closely as is practicable the targeted portfolio allocations……Rebalancing represents supremely rational behavior……When markets exhibit excess volatility, rebalancing enhances portfolio returns….Moreover, real-time rebalancing tends to cost less, as trades generally prove accommodating to the market….Yale’s trading activity during the fiscal year ending June 30, 2003, provides some insight into the potential magnitude of rebalancing profits….Careful investors rebalance….investors position portfolios to satisfy long-term investment goals.”

Variations of this formalistic rebalancing approach rebalance to somewhere within these allocation ranges, or use periodic cash flows to move the asset allocation of the various assets closer to what a rebalancing action would attempt to do. Often such approaches are a move towards a practical maintenance of the strategic weights, trading off between managing transactions costs and tracking error relative to the benchmark.

Such approaches may be called ‘static rebalancing’ because the limits are set ahead of time; however, the portfolio still drifts within the bands, as most policies are silent about what actions staff or Boards should take within the bands. In effect, pension funds are taking implicit bets within the range, as shown in Figure 4.2. Even Swensen (2005) acknowledges that, “Perhaps the most frequent variant of market timing comes not in the form of explicit bets for and against


78 Chapter 6 – various pages. Sections of this material and other references to Swensen (2005) are repeated verbatim in Swensen (2009).
asset classes, but in the form of passive drift away from target allocations. If investors fail to counter market moves by making rebalancing trades, portfolio allocations inevitably move away from the desired target levels.” Our approach towards traditional rebalancing is similar to that of a congressional candidate in Texas who commented, “That lowdown scoundrel deserves to be kicked to death by a jackass – and I am just the one to do it.”

David Swensen’s rationale is explained by the comment, “Strong evidence exists that markets exhibit mean-reverting behavior, a tendency for good performance to follow bad and bad performance to follow good.” The fallacy in Swensen’s approach is evident in a number of simple observations: (i) no evidence of the frequency (i.e., the time over which) and amplitude (i.e., the size) of mean reversion is provided, rendering the claim of mean reversion arbitrary; (ii) if an investor truly believes that markets mean-revert, then a more intelligent mean-reverting strategy could be developed (which is categorized as a SMART strategy), as opposed to a naïve range-based or “real time” rebalancing strategy; (iii) what is relevant here is not the mean reversion of a single asset class but rather all assets in the portfolio, as the frequency and amplitude of different assets would be different; (iv) the likelihood of a static rebalancing policy, given other choices, being optimal for a mean-reverting market is close to zero; and (v) one must be concerned with the relative asset performance, as portfolio weights are influenced by relative performance and not the absolute performance of a single asset class.

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79 Page 21.
The other disconcerting problem for pension funds (or individual investors) is that rebalancing policies were recommended to keep tracking error low relative to the SAA, but have little relevance to the liabilities, potentially increasing ALM risks and typically leading to large drawdowns in performance, as experienced by pension funds globally in 2008-2009 as also earlier in 2001-2002. SEI (2009) provides an overview of the practices adopted by 119 institutional investors in the United States and Canada, showing how pension funds have struggled with this concept; even more troubling are the suggestions made by the SEI (2009) authors on how to deal with this critical issue, given the importance attached to this as highlighted in MetLife (2009).

Table 4.1 provides the analysis of a simple simulation: Assume that an investor has allocated 60 percent to the S&P 500 and 40 percent to the Citi World Government Bond Index. The performance of different rebalancing strategies, assuming a one-sided transaction cost of 10bp for both assets is evaluated just for
2008. A multi-asset portfolio is not required to show how insidious blind rebalancing can be.

**TABLE 4.1 The performance of “naïve” rebalancing strategies in 2008**

<table>
<thead>
<tr>
<th>Performance Summary - Total Period</th>
<th>Annualized Return</th>
<th>Annualized Standard Deviation</th>
<th>Annualized Return-Risk Ratio</th>
<th>Worst ‘Simple’ Negative Performance</th>
<th>Maximum Drawdown</th>
<th>Ratio of Good/ Bad Risk</th>
<th>Success Ratio</th>
<th>Annual Turnover</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMK</td>
<td>-18.97%</td>
<td>23.61%</td>
<td>-0.8</td>
<td>-5.33%</td>
<td>-31.08%</td>
<td>1.02</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excess</td>
<td>-0.2%</td>
<td>0.02%</td>
<td>-12.67%</td>
<td>-0.01%</td>
<td>-0.2%</td>
<td></td>
<td>0</td>
<td>1.15%</td>
</tr>
<tr>
<td>BMK</td>
<td>-18.97%</td>
<td>23.61%</td>
<td>-0.8</td>
<td>-5.33%</td>
<td>-31.08%</td>
<td>1.02</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Strategy</td>
<td>-20.15%</td>
<td>22.59%</td>
<td>-0.09</td>
<td>-5.17%</td>
<td>-31.20%</td>
<td>0.97</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Excess</td>
<td>-1.16%</td>
<td>1.65%</td>
<td>-0.72</td>
<td>-0.89%</td>
<td>-1.06%</td>
<td>0.59</td>
<td>46.16%</td>
<td>20.52%</td>
</tr>
<tr>
<td>BMK</td>
<td>-19.42%</td>
<td>23.7%</td>
<td>-0.82</td>
<td>-5.37%</td>
<td>-31.32%</td>
<td>1.01</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excess</td>
<td>-0.46%</td>
<td>0.6%</td>
<td>-0.77</td>
<td>-0.25%</td>
<td>-0.76%</td>
<td>0.71</td>
<td>49.62%</td>
<td>26.71%</td>
</tr>
<tr>
<td>BMK</td>
<td>-19.66%</td>
<td>23.61%</td>
<td>-0.83</td>
<td>-5.59%</td>
<td>-31.5%</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excess</td>
<td>-0.7%</td>
<td>0.86%</td>
<td>-0.82</td>
<td>-0.29%</td>
<td>-1.18%</td>
<td>0.94</td>
<td>48.47%</td>
<td>11.99%</td>
</tr>
<tr>
<td>BMK</td>
<td>-19.7%</td>
<td>23.48%</td>
<td>-0.84</td>
<td>-5.43%</td>
<td>-31.43%</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excess</td>
<td>-0.73%</td>
<td>0.73%</td>
<td>-1.01</td>
<td>-0.32%</td>
<td>-0.99%</td>
<td>0.54</td>
<td>51.53%</td>
<td>14.86%</td>
</tr>
<tr>
<td>BMK</td>
<td>-19.27%</td>
<td>22.9%</td>
<td>-0.84</td>
<td>-5.34%</td>
<td>-30.63%</td>
<td>1</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excess</td>
<td>-0.3%</td>
<td>1.14%</td>
<td>-0.26</td>
<td>-0.44%</td>
<td>-0.79%</td>
<td>0.73</td>
<td>49.62%</td>
<td>12.11%</td>
</tr>
</tbody>
</table>

The options that are simulated include: (i) daily rebalancing back to the 60/40 mix (apparently practiced by the Yale Endowment); (ii) weekly rebalancing; (iii) monthly rebalancing; (iv) rebalancing back to the SAA based on a 3 percent range; (v) rebalancing back to the SAA based on a 5 percent range; (vi) rebalancing back to the mid-point of a 3 percent range; and (vii) rebalancing back to the mid-point of a 5 percent range. All these options are compared to the continuously, costlessly rebalanced 60/40 benchmark (BMK).

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81 These policies are actively recommended by consultants but can be tested only in a two-asset case. In a multiple asset portfolio, there is no unique solution and hence this cannot be tested without assuming qualitative judgment.
What is amazing, but not shocking, is that all naïve rebalancing approaches lost money in a period when the SAA also declined, as evidenced by the negative values in the column titled "Annualized Return." In only one case (3 percent mid-point), the success ratio (second to last column) was above 50 percent – which is the equivalent of doing worse than a fair coin toss. Increasing the turnover does not necessarily reduce the loss, as shown in the column titled "Annualized Turnover." The biggest problem though is that the maximum drawdowns (in absolute terms) of all but one naïve rebalancing options are worse than the drawdown of the BMK. In short, the naïve rebalancing policies acted like an anchor tied to the leg of the captain of the Titanic.

**Static LDI**

Finally, many funds increased their duration to match those of the liabilities in an attempt to lower ALM risks. This strategy had been aggressively promoted by asset managers and derivatives overlay advisors. “LDI focuses specifically on the duration gap arising from interest rate mis-match between the assets and the liabilities. In broad terms, it is the mechanism for matching the two in order to improve solvency over time.”\(^2\) Many asset managers created duration pools and convinced clients to invest in these pools to extend their duration. Using the example provided in Table 3.1, one can see that this would involve ensuring that the client’s duration is extended to 15 years (which is considerably longer than

\(^{82}\) See Watts (2006).
the typical duration of the bond funds that pension funds invest in, which is typically 4-5 years). “Typically, funds need to invest 20-25 percent of their assets into the LDI pools to fully hedge the interest rate risk of their liability, leaving the fund with a significant portion of assets invested in a diversified return portfolio.” While this approach is appropriate, it is once again a static approach, and extending the duration is a timing decision (much like the rebalancing decision). Hence, the point of time that a pension fund extends the duration (i.e., when rates are perceived to decline) and the point of time that it reduces the duration (i.e., when rates are expected to rise) can be a source of additional value while hedging interest rate risk. Lowering the volatility of the asset-liability ratio does not fulfill the complete objective, as it focuses only on the risk and not on the return differential.

Extending the duration may be a hollow measure, as the return of the assets has to match, and even exceed (depending on the funded status), the return of liabilities and, with yields at current levels, long duration bonds do not have the potential to provide adequate returns relative to liabilities.

Chapter 6 addresses the issue of dynamic liability hedge management after demonstrating the basic premise of SMART.

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INNOVATIVE APPROACH

Before describing the SMART approach, this book must refer to a totally unsubstantiated and rambling series of vitriol from Swensen (2005). In an attempt to discredit “market timing”, an exercise that Swensen also indirectly engages in through his mean-reverting rebalancing trades, Swensen (2005) states, “Maybe investors keep to policy asset allocations because they recognize the futility of consistently making the relative asset class valuation assessments necessary for market timing success, particularly when such assessments rely on a bewildering collection of unknowable economic and financial variables.”\(^{84}\) This comment precedes the commendation of his “sophisticated team of investment professionals [that] manages the funds on a day-to-day basis, providing the staff support needed for management intensive activities.”\(^{85}\)

Not satisfied with this criticism, Swensen (2005) continues, “[A]ctive market timers usually fail. Market-timing requires taking relatively few, generally undiversifiable positions. Timing decisions involve the large questions of asset-class valuations, forcing short-term asset allocators to develop views on an impossibly broad range of factors...Serious investors avoid entering the market-timing morass.”\(^{86}\) Swensen (2009) contains a similar unsubstantiated diatribe.\(^{87}\) Such a tirade, expressed in such dismissive language, is inexplicable, especially when it is obvious that the CIO of a major fund should invest time and resources,

\(^{84}\) Page 20.  
\(^{85}\) Page 197.  
\(^{86}\) Page 151.  
\(^{87}\) Pages 52, 53, and 64.
especially with a sophisticated (and possibly highly paid) team at their disposal, to
discern the factors that affect the relative movement of assets forming the core
asset allocation, which by Swensen’s own admission is the most important
decision. Moreover, SMART rebalancing seems to address a fundamental
misunderstanding: namely, that the CIO needs to be correct only 52-53 percent of
the time in making these tilts, and therefore needs not a whole array of factors to
make these decisions but only those that can be reliably modeled by using
economic logic and clean and consistent data.

**SMART Rebalancing and LDI**

The SAA should be made dynamic and based on market factors, and this
application is termed, “The View-based SAA” (and implementing it after allowing
for the view-neutral dynamic SAA described above). More important, the
dynamism is not intended to keep tracking error low or raise the information
ratio, but *ideally to help assets outperform liabilities while increasing the
correlation* (and thereby lower the ALM risks). The application of these concepts
will be demonstrated in Chapters 5, 6, and 8. What is being proposed is not
“portfolio insurance” – which is a strategy (a bit discredited) that is based purely
on the price movement of assets.

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88 This section leverages Muralidhar and Muralidhar (2009).
Even though we live in a dynamic world, most of the academic work, portfolio management techniques, and even risk budgeting approaches seem to have fallen short of the practical problems encountered by plan sponsors. The proposed approaches are usually static and assume that in the long term, which is rarely any manager’s time horizon, such a static approach is optimal. The industry tilts towards an over-reliance on “optimization” approaches which assume that long-term returns and risk can be reasonably guesstimated to structure long-term portfolios. Though such approaches allow the derivation of an acceptable “starting point” for portfolio structure and asset allocation, the subsequent commitment to maintaining this structure/allocation over different economic cycles and investment regimes has definite shortcomings. In many ways, this is akin to building a heating/air-conditioning system that operates at an average temperature all year round while ignoring the actual outside temperature and the seasonal changes. For example, recommendations such as “purchase an asset management product to match the liability cash flows”, “hire portable alpha managers and statically replicate the beta”, and “rebalance your portfolio back to the benchmark weights at the end of the quarter or when some range has been reached” are all static and have severe limitations, as they presume that the pension fund sponsor can relax after making these ‘crucial’ decisions.

Such approaches are often marketed as “silver bullets” that require the single action of hiring an external manager, with little thought to the allocation to them in each period, or of implementing a rebalancing policy and ignoring it for many periods till some target (calendar period or range) is met. Therefore, the portfolios that result are sub-optimal, and it should be apparent that such naïve recommendations are inadequate at the least, and could potentially jeopardize
the pension fund at the worst. Good governance of multi-asset, multi-manager portfolios requires a disciplined approach to both the selection of assets/managers and then the determination of the appropriate asset allocation to these assets or managers from time to time. After all, Figure 4.1 for two asset managers (and similar analyses for all asset classes) show clearly how assets are influenced – either in a fashion that is known to investors because of good economic intuition on markets or the knowledge of managers or occasionally in a manner that may be unbeknownst to even the managers themselves (e.g., most currency managers did not realize that they are long volatility in creating their portfolio management products).  

Most important, the assets included in a portfolio (i.e., asset classes and even managers), as modern portfolio theory has taught us, are ideally uncorrelated with each other (or at least have low correlation). Swensen (2009) advises that, “[B]y identifying high-return asset classes that show little correlation with domestic marketable securities, investors achieved diversification.” The logical extension of the assumption of low correlation is that, in any given period (whether determined by market regimes, economic cycles, or calendar periods), some of these assets will perform better than others in the portfolio. There will also be times when assets will outperform their expected returns while still others will underperform these expectations. The static/naïve approach to asset allocation assumes (or hopes) that these pluses and minuses will even out over short windows of time and should not be a concern in the ongoing asset allocation decisions. The economic crisis of 2008 proved the fallacy in that

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90 Muralidhar and Neelakandan (2002).
91 Page 63.
argument, severely threatening solvency and forcing major corrective actions. Moreover, many ongoing asset allocations are necessary as a result of cash flows generated by the pension management fund by way of dividends, coupon payments, private equity distributions as well as contributions and disbursements to meet ongoing pension obligations.

SMART portfolio management takes the view that this periodic variation in the performance of all assets in a fund demands that responsible asset managers make asset allocation decisions to best position their portfolio for these regimes/cycles/market conditions and, by doing this expertly and systematically, greatly improve the return/risk and eliminate, in large part, knee-jerk, emotional decision-making that cannot be explained to a wider audience (or in this case – the principal). After all, CIOs expect at least as much from their external asset managers and it would therefore be only logical to extend this same responsibility one decision level up to the portfolio’s internal managers.

Asset and manager returns are constantly moving up or down daily, resulting in changes in the weights of assets and managers in the portfolio every day. Such fluctuations are to be expected because of volatility, and correlation assumptions in SAA studies. In addition, CIOs’ decisions (often relatively ad-hoc) on what to do with contributions or which assets to liquidate to pay pensions also influence performance. Many pension funds feel that if they do not take an explicit decision about a manager or an asset weight, they do not have a bet on the markets. Quite the opposite is true! If a client adopts a static approach in hiring a manager with an initial allocation and in letting that allocation change over time because of market movements, they are opting for considerable risk. If the manager
performs well, then their weight in the portfolio increases, and avoidance of reduction in the weight implies a view that the plan sponsor assumes that the manager will continue to outperform.

The same analysis applies to assets (or beta) that may have drifted in allocation above the long-term strategic weight because of strong recent performance. To desist from making an explicit decision implies subscribing to the view that this asset will continue to outperform. Similarly, triggering an *automatic* rebalancing decision to reduce (increase) the weight of an asset back to its benchmark weight at the end of a quarter, because a particular day has been reached, implies subscribing to the view that this asset will do worse (better) than other assets – otherwise commitment to such a decision would seem contradictory. In addition, a rebalancing decision makes the assumption that the benchmark allocation is the most desirable at *all* times (under all market conditions), and hence managing back to this asset allocation is best for the portfolio, regardless of current market conditions, and, more important, liability growth. However, all CIOs must realize that every decision, whether to overweight/underweight asset classes or managers, or continue to allow the portfolio to drift, are active decisions – whether made explicitly or implicitly.

Having discussed the implicit bet in rebalancing portfolios, the impact of currencies on portfolio performance and risks is addressed. No decision has been more neglected than the decision on optimal currency hedge, as most consultants who were not well versed with currency issues chose to refrain from expressing a
view explicitly while expressing a view implicitly.\textsuperscript{92} Most currency hedging studies acknowledge that currencies are volatile but have zero expected return. Therefore, the choice of a static passive hedge is a bet on the market direction of all currencies relative to the base currency – one could argue that this is a very dangerous bet to take in global markets.

The effective management of assets would suggest that a pension fund be run like a professional asset management company, with staff using market intelligence and SMARTs to make implicit bets in a portfolio explicit and improve solvency. After all, the correlation of these assets (used in the SAA) reflects the multi-factor relationships across assets. Hodgson (2005) makes a very eloquent case for such a process.

This SMART approach, therefore, involves the following steps:

1. Identify all the asset allocation decisions (and possibly currency) being made in the portfolio.
2. Develop investment rules to guide the desired asset allocation tilts in the portfolio. These rules will define the assets that should be overweighted or underweighted relative to the target allocation.

\textsuperscript{92}The author was asked to speak at a Board retreat for an Ohio public pension plan in 2000 on the topic of currency management, having implemented a similar approach as a plan sponsor. The head consultant and chairman of the consulting company advised against such a decision without backing up their recommendation with any evidence of research – we can make such a claim as staff at the fund requested data from the consultant on how they had arrived at such a conclusion and shared it with the author. The consulting company had not even collected data on how currency managers may have assisted this plan before making this recommendation, though publicly available data at the time could easily show otherwise – Strange (1994), Baldridge et al (2000). Since then, currency management has become more mainstream, but the pension fund lost an opportunity to manage implicit currency decisions effectively for better risk management and, potentially, profit.
based upon the levels of certain market or economic factors, typically sourced from finance or academic journals. These factors will be measures of valuation (whether an asset class is over- or under-valued), economic activity (different economic conditions favor different asset classes), seasonality, momentum, market sentiment (volume, volatility, risk aversion, fund flows, etc.). After all, it is these economic relationships that result in a very blunt correlation statistic, rendering such analysis critical to the potential for exploiting the implications of low correlation.

Take, for example, the conclusions by Campbell and Shiller (1998a): that the price-earnings (P/E) ratio and the dividend-price (D/P) ratio are useful forecasting variables for the long-term price return of stocks. They suggest that:

- A low P/E implies that stock price growth will increase (as P adjusts) over the long term.
- A low D/P implies that price growth will decline in the long term.

This insight can easily help a SMART investor develop a formal process to tilt allocations between Stocks and Cash, based on these two parameters.

In the case of the two currency managers highlighted in Figure 4.1, a more formal rule can be specified as follows (Figure 4.3), relative to a static, constantly rebalanced 50-50 mix. In this example, the SMART rule is calibrating an automatic reaction to an evolution of the underlying parameter. Notice the simplicity of the rule and the lack of over-optimization of choice of triggers. In short, this rule states that if the historical EUR/USD implied volatility exceeds 1
standard deviation from the mean (Z-score), then the allocation to Manager 102 should be rebalanced to 49 percent, and the allocation to Manager 117 increased to 51 percent (the actual size shifts depending on liquidity, but 1 percent is used merely to calibrate the model). The opposite is true when the implied volatility falls; and in the middle range, no tilt need be taken, as this avoids decision-making until parameters are reasonably stable and clear on information content (as opposed to arriving at a decision on noise).\(^\text{93}\)

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**Figure 4.3.** Example of a simple, SMART rule, based on the EUR/USD implied volatility – What to do, When, How much and Why

<table>
<thead>
<tr>
<th>Description</th>
<th>Criteria Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUR Option Implied Volatility: When this factor is low, overweight manager 102 and underweight manager 117</td>
<td>IF {{Historical Z-Score Of Euro Zone, Implied Option Volatilities, EUR/USD 1 year, Ask, Close, EUR &lt; -1}} THEN \textit{Allocate} 51% of Smart Currency Fund-Manager 102-Rolled Up Mgr</td>
</tr>
<tr>
<td></td>
<td>ELSE IF {{Historical Z-Score Of Euro Zone, Implied Option Volatilities, EUR/USD 1 year, Ask, Close, EUR &gt; 1}} THEN \textit{Allocate} 49% of Smart Currency Fund-Manager 102-Rolled Up Mgr</td>
</tr>
<tr>
<td></td>
<td>ELSE \textit{Allocate} 50% of Smart Currency Fund-Manager 102-Rolled Up Mgr</td>
</tr>
</tbody>
</table>

3. Quantify the historical performance of such an asset allocation approach to understand the risk/return profile of each factor model and possibly fine-tune the selection of the various factor-based rules to ensure that they meet the investment objectives or constraints.

In the case above, the rule was tested for the period October 2002–December 2005 (Figure 4.4) to allow for out-of-sample evaluation. This rule is interesting in that it does not come with high success (48 percent), but

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\(^{93}\) See also Appendix to Chapter 2.
the confidence in skill is high (89 percent), given the short time span over which it was tested. However, a one percent allocation tilt results in four bps of excess indicating that a 10 percent allocation tilt would generate 40 bps.

4. Combine many such factor-based rules into a diversified strategy that provides a net indication of the relative attractiveness of each asset class and currency so that the risks of making decisions on a single economic factor are mitigated.

5. Implement these asset allocation recommendations in a disciplined way (just as one would with static rebalancing). One could argue that the weights to each of these rules can also be dynamic, but for simplicity this level of dynamism of asset allocation based on factors is adequate.

6. In case an investor tends to believe that they must be right all the time in the decisions they make (as had been argued in the context of Swensen’s comments), the data tabulated in Figure 4.4 shows that, even with being right only 48 percent of the time, the SMART rule added value with high confidence that the performance is from skill. Combine this with many more rules to get a higher success ratio (which need not exceed 55 percent) for the investor to outperform the static, constantly rebalanced naïve approach. This is shown in greater detail in Chapters 6 and 8.
In short, it does not take a genius to do better than the rebalanced benchmarks because of the embedded bets, and SMART portfolio management provides the structure and process to manage assets (and liabilities) effectively.

Figure 4.4. Summary results of shifting 1 percent of assets relative to a 50-50 mix of managers 102 and 117 (October 2002-December 2005)

**SUMMARY**

Pension funds cannot adopt static policies in dynamic markets because static policies imply unmanaged bets. The CIOs should incorporate four levels of dynamism in managing the assets to improve solvency: (i) Dynamic LDI (Chapter 6); (ii) View-neutral Solvency-Based Beta Adjustment (Chapter 5); (iii) View-based SMART Beta Management (Chapter 6); and (iv) SMART Alpha Management (Chapter 8). The application of these techniques is effectively the complete implementation of the concepts underlying Arikawa et al (2005), Brock (2005), Hodgson (2005), and Mulvey (1994). Rules need to be clearly articulated to indicate “What to do; When to do it; How much to do; and Why.” Explicit factor analysis and exposition of these rules exploit the correlation assumptions
underlying ALM studies and lend themselves to transparency and good governance, whereas optimized portfolios are derived from black boxes where the investor is not sure whether the decision is being driven by the return, correlation, or volatility assumption.
Two Approaches to SMART View-Neutral LDI

“This strategy represents our policy for all time. Until it’s changed.”

Marlin Fitzwater\textsuperscript{94}

“There may be a recession in stock prices, but not anything in the nature of a crash.” Irving Fisher\textsuperscript{95}

“Stock prices have reached what looks like a permanently high plateau.”

Irving Fisher\textsuperscript{96}

BACKGROUND

Pre-2008, money was pouring into less liquid and more complex strategies, and pension funds, especially in the United States, drifted towards endowment-based investing (Swensen 2009), potentially ignoring the ALM perspective. Institutional investors had benefited from high returns to capital and ignored the Hyman Minsky paradigm – the more things look good, the worse they will get. However, the recent financial turmoil globally and the palpable hesitation over the fundamental justification of these high returns have tempered expectations going forward.

\textsuperscript{94} Petras (2001), page 95, quoting Marlin Fitzwater, White House spokesperson under President George Bush (Senior), on national security strategy.

\textsuperscript{95} Petras (2001), page 52, quoting economist Irving Fisher, six weeks before the 1929 crash.

\textsuperscript{96} Petras (2001), page 52, quoting economist Irving Fisher, nine days before the 1929 crash.
Increasingly, enlightened regulation in countries such as the Netherlands has focused on the solvency of pension plans as the determinant of success. The United States lags far behind in giving the regulator teeth and input into helping pension funds achieve solvency. While the US Pension Protection Act (PPA) requires corrective action vis-à-vis contributions, it falls short of the three-pronged response (raising contributions, lowering benefits or indexation, and reducing asset risk) required by the DnB. Even though pension plans became more sophisticated in determining their investment strategy (increasingly looking for “alternative” opportunities), they missed the opportunity to lock in their previous asset gains and preserve solvency. In addition to extending into non-marketable asset classes, pension plans contemplated derivative strategies on their assets.

This chapter focuses on certain innovative SMART solvency-enhancing strategies, and the Appendix focuses on a comparison of one specific SMART View-Neutral (VN) strategy to the simplistic option-based strategies that investment banks sold pension funds. The analysis also includes a brief overview of an alternative, though related, View-Neutral approach that would have been successful in protecting solvency in 2008. The situations under which each strategy can lead to efficiency gains for pension plans in an ALM context is discussed. Further, the choice of fixed income portfolio (traditional short duration, with credit, versus liability matching) may lend itself to effective SMART management of solvency. It thereby becomes apparent that relatively simple strategies can be instrumental in ensuring ongoing solvency.
The analysis, which is conducted in the context of a DB pension plan, is a bit dated (having been developed in 1997), but the robust conclusions remain durable. Simply put, the plan has to make annual benefit payments many years into the future and has inflows due to contributions that are being made by the plan’s sponsor and participants. The act of withdrawing/adding funds to a pension fund compels a CIO to make rebalancing decisions at a minimum every year (without any use of derivatives, etc). It becomes clear that a simple, rigorous rule based on the funded status, if applied to these annual cash flows to help revise the SAA – as opposed to naively rebalancing to the static SAA –, has substantial benefit in ensuring future solvency. Such a SMART rule was provided in Chapter 4 (equation 4.1).

Since the investment horizon of pension plans is normally long term, the innovative strategies in the simulation are evaluated over a period of nine years. The choice of horizon is merely for simplicity and does not affect the results; however, it is assumed that plans review their investment policy annually. Appendix 5.1 covers a more elaborate menu of strategies that can be implemented if Boards permit leverage to determine optimal solvency-protecting strategies. The relevance of this discussion is that it demonstrates again that consultants/pension plans often unintentionally take an implicit bet in conducting SAA studies when they intentionally prevent leverage. This may be a reflection

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97 Muralidhar (2001). Thanks to Ronald van der Wouden for his hard work, contributions and partnership in this case study.
98 See, for example, Peskin (1997) and Boender (1998).
of the fact that some countries preclude leverage in asset allocations, as misguided regulation imposes unusual conditions that can impact solvency. Although pension plans have become more sophisticated and regulation is getting more solvency-focused, the practice of examining assets and liabilities in concert is not fully integrated in the decision-making process. It may be argued that this shortcoming afflicts endowments and foundations in particular, as the liabilities are not clearly articulated. The presence of liabilities is the only reason for the existence of pension plans; hence, ignoring the liabilities completely would lead to a very inadequate and potentially incorrect analysis. To give an indication of the importance of liabilities, Figure 5.1, taken from Muralidhar (2001), provides the growth of the aggregate assets and liabilities of pension plans in the United States covered by the Pension Benefit Guarantee Corporation (PBGC) between 1980 and 1996.

These graphs clearly demonstrate that although, on aggregate, pension plan assets rose impressively in the two decades from 1980, the funded ratio declined quite dramatically. In a more recent analysis, “Wilshire Consulting's eighth study covering defined benefit plans sponsored by S&P 500 Index companies notes that DB pension assets for S&P 500 Index companies declined by $310.2 billion – from $1294.3 billion to $984.1 billion – while liabilities increased $21.9 billion, from $1199.7 billion to $1221.6 billion. As a result, the aggregate funding ratio (assets divided by liabilities) for all plans combined decreased from 107.9 percent to 80.6 percent, and a $94.6 billion surplus at the beginning of the year turned into a $237.5 billion deficit. Wilshire's analysis of the 323 companies in the S&P 500 that

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99 A number of pension plans still develop their policy decisions on mean-variance types of analyses, or a consensus benchmark such as the average asset allocation of their peer group.
maintain DB plans indicates that 92 percent of those plans are underfunded, notably higher than the 62 percent reported for the previous year. Moreover, the median (50th percentile) corporate funded ratio is 73.3 percent, a decline from 96.6 percent last year.”

Figure 5.1. Important to develop an effective ALM policy.

The data on the Dutch pension system (provided earlier) is equally troubling, as regulations require pension plans with funded ratios less than 105 percent to implement corrective measures which include increases in contributions, less asset risk, and reduction in benefits. Though all plans in the Wilshire study may not have experienced this outcome, one is moved to question whether the investment policies of some of these plans were suitable, given their liability

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structures. It is surprising that even after the 2001-2002 decline in solvency, many pension plans were unprepared for the 2008 recession. To ensure that plans are not subjected to such questions, and to emphasize the importance of the liabilities, the analyses here are conducted in a framework where the investment decisions are integrated with a consideration of revised liability valuations and hence funded status.\textsuperscript{101} Interestingly, even Frank Russell now endorses such an approach (Collie and Gannon 2009). These principles can be more broadly applied to any investment problem – whether for an insurance company or a central bank managing reserves or an endowment/foundation seeking to achieve a spending target.

**THE STRATEGIES**

Prior to making a simple comparison between a static SAA and a simple, SMART View-Neutral SAA, the assumptions on the economy and the pension plan (investment and contribution policy) are highlighted to set the stage for the analysis. Three critical distinctions for the strategies are highlighted: (i) static versus dynamic investment policies; (ii) portfolios with and without options; and (iii) leveraged versus unleveraged portfolios. The static investment strategy proposes a fixed allocation throughout the investment horizon, whereas the dynamic investment strategy focuses on the ability to revise the asset allocation from one period to the next. The frequency of adjustment could be daily, but for simplicity it is assumed that decisions are made once a year on January 1.

\textsuperscript{101} Ideally, pension plans should jointly optimize contribution policy and investment policy. This is covered in greater detail in Krishnamurthi, Muralidhar, and van der Wouden (1998 a, b), and Dert (1995).
Optioned investment strategies are based on the ability to acquire a long put position on the portfolio’s domestic equity portion (either on a static or dynamic basis) in an attempt to protect against the decline in the value of assets. Finally, leveraged investment strategies are based on the ability to construct portfolios that leverage cash or other investment grade fixed income (either on a static or dynamic basis).

Leaving the analysis of (ii) and (iii) for Appendix 5.1, the focus here is on the simple SMART View-Neutral strategy which can be adopted immediately by clients globally, whereas the other strategies may require revisions in regulation or investment policies on the use of derivatives, leverage, etc. These strategies are easily implemented (and at low cost) if CIOs adopt the basic concepts of liability and asset definition and replication highlighted in Chapter 3.

THE INVESTMENT ENVIRONMENT

This section describes the economic environment created for the analyses. Plan-specific issues are highlighted, followed by a description of the assumptions made on asset returns, correlations, and volatility. In addition, assumptions are made on the policy issues that deal with the restrictions and the freedom that the pension plan has in constructing its portfolio. The policy assumptions are needed to prevent investment policies from being impractical or unrealistic.
Plan-Specific Issues

The experiments are based on the demographic profiles (i.e., length of employment, life expectancy, salary growth) of participants in a pension plan. Based on these profiles, a hypothetical DB plan is simulated (entitling the employee, after 35 years of service, to a replacement rate of approximately 70 percent of her final salary – which is in line with the Aon (2008) replacement rate study). The benefits are unconditionally indexed to price inflation, and the plan’s liabilities are measured under the Closed Group method. Further, a discount factor of 4 percent real is used for discounting the liabilities. Assume a 125 percent initial funded ratio which is where many funds probably were situated prior to 2008. Sensitivity to the initial funded ratio is evaluated and reported. The maturity of the plan, measured by the ratio of assets to total salary, is around 10. For simplicity, the policy horizon of this fund’s Board of trustees is assumed to be nine years with an annual review. The time horizon and the frequency of review do not affect the results.

To deal with the uncertainty and the impact of asset returns, different scenarios of the economic environment were created, each scenario representing the development of these returns over the chosen span of nine years. An investment policy is evaluated for each scenario, and the impact of this particular investment policy is captured by solvency risk measures (Chapter 3), which take into account

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102 None of these assumptions impacts the generic results of the analysis. Estimation under the Closed Group method means that the liabilities are the value of benefits expected to be paid, with both salaries and service projected to expected dates of termination or retirement, including the benefits in payments. This would be equivalent to valuation on a Projected Benefit Obligation (PBO) basis, but with reflection of expected future service.

103 This is quite different from the discount rate for U.S. plans which use a long-term corporate bond yield instead.
the policy’s behavior in all the scenarios. The scenarios are generated by a model that assumes that each economic factor follows a random walk. In addition, the statistical relationships between the economic factors are preserved in the simulations. The most important characteristics of the generated scenarios are depicted in Table 5.1.

**TABLE 5.1 Characteristics of economic variables**

<table>
<thead>
<tr>
<th></th>
<th>Annual Expected Nominal Return (Arithmetic)</th>
<th>Standard Deviation (Annual Volatility)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Price inflation</td>
<td>4.0</td>
<td>3.0</td>
</tr>
<tr>
<td>U.S. equity</td>
<td>10.5</td>
<td>15</td>
</tr>
<tr>
<td>U.S. fixed income</td>
<td>6.5</td>
<td>5.2</td>
</tr>
<tr>
<td>High-yield bonds</td>
<td>8.0</td>
<td>9.8</td>
</tr>
<tr>
<td>Real estate</td>
<td>7.0</td>
<td>18.0</td>
</tr>
<tr>
<td>Private equity</td>
<td>10.5</td>
<td>27.0</td>
</tr>
<tr>
<td>Cash</td>
<td>5.2</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Embedded in Table 5.1 are the assumptions of an expected real risk-free rate of 1.2 percent (i.e., the difference between cash and expected inflation), a real bond return of 1.3 percent (i.e., the difference between fixed income and cash), and an expected real equity risk premium of 4 percent (i.e., the difference between the expected return on equity and fixed income). Further, historical data of 10 years is used to estimate the correlations among these asset classes (see Table 5.2). Back in 1997 when this analysis was first conducted, the data on expected returns and correlations were cross-checked with major consultants and asset managers to

---

104 See Dert (1995) for a technical discussion of conducting such analyses. These are standard simulation techniques.
ensure that these were reasonable; however, no attempt was made to examine the correlation data in the manner described in Chapter 4.

**TABLE 5.2 Correlations among asset classes**

<table>
<thead>
<tr>
<th></th>
<th>US EQ</th>
<th>NUS EQ</th>
<th>US FI</th>
<th>NUS FI</th>
<th>HY</th>
<th>EM EQ</th>
<th>PE</th>
<th>RE</th>
<th>PI</th>
<th>Cash</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. equity</td>
<td>0.5</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-U.S. EQ (unh)</td>
<td>0.4</td>
<td>0.2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S. fixed income</td>
<td>0.4</td>
<td>0.3</td>
<td>0.4</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-U.S. FI (hedged)</td>
<td>0.4</td>
<td>0.3</td>
<td>0.4</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-yield bonds</td>
<td>0.5</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emerging markets EQ</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private equity</td>
<td>0.4</td>
<td>0.1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real estate</td>
<td>0.1</td>
<td>0.1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.1</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price inflation</td>
<td>-0.3</td>
<td>-0.2</td>
<td>-0.1</td>
<td>-0.2</td>
<td>-0.3</td>
<td>-0.2</td>
<td>-0.2</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Cash</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Policy Issues**

A distinction is made between two tools available to pension funds for managing their plan, namely, the investment policy and the contribution policy. The method of specifying and jointly optimizing these two is provided in Dert (1995), and the implications of such joint optimizations for pension plans is covered in Krishnamurthi et al (1998 a, b). While the entire focus of this book is on asset strategy, contribution policy is the ability to revise the amount of money injected by the plan sponsor to ensure solvency. Some restrictions on the use of these tools have been incorporated into the analysis to prevent the policy from becoming unrealistic.

105 The method of specifying and jointly optimizing these two is provided in Dert (1995), and the implications of such joint optimizations for pension plans is covered in Krishnamurthi et al (1998 a, b).
Investment Policy

The pension fund has been allowed to invest in nine different asset classes (Table 5.1) which give a fair representation of the current investment opportunities for pension plans in the United States. In addition, the allocation to several classes has been fixed to a certain percentage to avoid significant allocation changes, from one period to the next, in asset classes that are illiquid. An alternative route to a similar result would have been to increase transaction costs, or exclude these completely from the evaluation, as suggested in Chapter 3, but this study was originally conducted in 1997 when futures-based indices were proposed, but gained little endorsement. Table 5.3 gives an overview of the asset classes that are being fixed and at what level, and this is not an unrealistic assumption for pension plans today that have invested in these assets (and possibly other alternatives such as hedge funds to the tune of 15-20 percent of the entire fund).

Contribution Policy

In general, pension plans (and individuals, as shown in Chapter 9) have the ability to revise the contribution rate from one year to the next. The contribution rate is the percentage of the total salary of the active (i.e., contributing) workforce that is contributed to the pension plan. This rate is often determined by either

---

106 "Hedge funds" are excluded as they are not an asset class but rather an investment strategy.
107 Given the expected returns and volatilities of these asset classes, attention needs to be paid to rebalancing, but constraining these allocations keeps the problem within practical limits.
108 This is not a buy-and-hold strategy; in order to rebalance to the same allocation, transactions costs will need to be considered. However, in the case of Real Estate and Private Equity, portfolios are infrequently marked-to-market, rendering rebalancing difficult. In High Yield and Emerging Equity, rebalancing is affected by cost and delay in liquidating positions.
actuarial projections or accounting rules. In occupational pension plans, the contributions are made by the employer and in some plans, by the employee. Generally, the employee’s portion of this amount is a fixed rate, whereas the employer’s part may be flexible and has therefore to be determined from one period to the next. However, the flexibility and levels of these contribution rates have practical limitations. For most organizations, it is difficult to accept a significant increase in the contribution rate, as it jeopardizes other activities. In other cases, pension regulations determine the contribution when solvency declines below 100 percent (see the U.S. PPA).\footnote{http://www.pbgc.gov/media/pension-legislation/content/page15921.html}

**TABLE 5.3. Fixed and floating allocations**

<table>
<thead>
<tr>
<th></th>
<th>Fixed/Floating</th>
<th>Allocation (if fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. equity</td>
<td>Floating</td>
<td></td>
</tr>
<tr>
<td>Non-U.S. equity</td>
<td>Floating</td>
<td></td>
</tr>
<tr>
<td>(unhedged)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emerging markets equity</td>
<td>Fixed</td>
<td>5.0</td>
</tr>
<tr>
<td>U.S. fixed income</td>
<td>Floating</td>
<td></td>
</tr>
<tr>
<td>Non-U.S. fixed income</td>
<td>Floating</td>
<td></td>
</tr>
<tr>
<td>(hedged)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-yield bonds</td>
<td>Fixed</td>
<td>2.0</td>
</tr>
<tr>
<td>Real estate</td>
<td>Fixed</td>
<td>7.0</td>
</tr>
<tr>
<td>Private equity</td>
<td>Fixed</td>
<td>3.0</td>
</tr>
<tr>
<td>Cash</td>
<td>Floating</td>
<td></td>
</tr>
</tbody>
</table>

It has earlier been pointed out that the initial funded ratio of the hypothetical pension plan is 125 percent. The contribution policy is so planned that at this
funded ratio level the basic total contribution rate will be 7 percent,\textsuperscript{110} which can be seen as the fixed portion of the employees’ contribution. If the funded ratio falls below 110 percent, this rate will be increased; on the other hand, if the funded ratio increases to levels above 140 percent, this rate will be decreased. The nature of the plan does not allow increases in the contribution level from one year to the next that go beyond 5 percent, once the contribution rate exceeds the basic rate of 7 percent. In addition, the contribution level is restricted to be no higher than 25 percent.\textsuperscript{111} The use of this contribution policy is critical to show that dynamic strategies are effective and will become evident further into the chapter.

\textbf{METHODOLOGY}

\textbf{STATIC AND DYNAMIC INVESTMENT STRATEGIES}

A static investment strategy implies a set of allocations to which the portfolio is rebalanced annually. Since the strategies are evaluated in a multi-period framework, the investment strategy can be revised from one period to the next. Static investment strategies, where the portfolio is rebalanced every year back to an initial allocation, are evaluated. The SMART View-Neutral (or the dynamic) strategies

\textsuperscript{110} One could argue that contributions are not necessary for a high funded ratio. This assumption is made as situations where the funded ratio is less than 100 percent are considered and this assumption removes the need to have to normalize for different contributions.

\textsuperscript{111} In the analysis, negative contribution rates are permitted so as to make the comparisons simpler to understand. Most plans do not allow for negative contribution rates (i.e., liquidating the pension fund’s assets to return monies to the company or individuals) for regulatory reasons.
approach permits the asset allocation to change to a new optimal allocation every year, based on the plan’s funded ratio.\textsuperscript{112} The logic behind this method is that if a pension plan’s financial situation improves (i.e., the funded ratio increases), then the ability to rebalance to a more risky portfolio is enhanced because of the increase in the plan’s risk-bearing capacity. Consequently, by taking on a more risky position, the ability to generate more returns will probably increase. The intuitive reader will recognize that this is a form of delta hedging the solvency option, using asset rebalancing (since solvency options are either not provided by investment banks or outrageously expensive).

**OBJECTIVES AND TARGETS**

The first step is to set targets that give an indication of the achievement of the plan’s solvency objectives. A funded ratio of 100 percent indicates that the plan’s current assets are equal to its liabilities. A ratio that is less than 100 percent indicates a shortfall and that the plan is underfunded, whereas a ratio higher than 100 percent indicates that the plan has a surplus. Once the funded ratio declines below 100 percent, asset returns must exceed the “return” on liabilities to ensure a return to full solvency.

Consequently, the probability that the funded ratio in any year is lower than 100 percent will be used as a measure of the risk that the plan is bearing. However, this measure does not give an indication of the extent to which the funded ratio is below this threshold. In order to capture this, the downside deviation is used as a risk measure. The downside deviation represents the volatility of the shortfall

\textsuperscript{112} See Boender (1998) for a description and empirical results on this strategy.
when the funded ratio is lower than the threshold, and hence indicates the extent to which the funded ratio is lower than this threshold.\textsuperscript{113} The objective should be to minimize downside risk.

In this chapter, the focus is primarily on the downside deviation risk measure and the probability of not achieving a threshold for the funded ratio of 100 percent. These being generic measures for all plans, they lend themselves to comparisons across plans, unlike comparisons of investment returns which do not normalize for different liabilities.

While the main objectives are to minimize the occurrence and the extent to which the plan’s funded ratio is lower than 100 percent, CIOs should try to maximize wealth and minimize the contributions made by the plan sponsor. These objectives are in some sense opposed to each other; however, in selecting the “right” investment strategy, a Board must make a trade-off between these objectives.

In general, three clear objectives may be defined for CIOs of a pension plan: (i) maximization of the funded ratio, i.e., maximization of the plan’s wealth; (ii) minimization of the contributions’ level and volatility; and (iii) minimization of the occurrences of underfunding (i.e., minimization of downside risk).

\textsuperscript{113} The downside risk of a decline in the funded ratio below a threshold is analogous to the downside deviation of portfolio returns. See Sortino and van der Meer (1991). The equation for this would be: \textit{Downside Risk} = \left[ \int_{x=0}^{x=\infty} x^2 f(x) dx \right]^{1/2}, where \( x \) is a (negative) surplus and \( f(x) \) the probability that a surplus occurs of the size \( x \).
FRAMEWORK FOR COMPARISON – A NEAT TRICK

This section describes the method for comparing different investment strategies which is completely dependent on the objectives and consequently closely related to the risk measures used. Pension plans must control the volatility of contributions, as it is not feasible for plan sponsors to cope with huge increases in the contribution rate from one year to the next. This objective is incorporated in our analysis by constraining annual increases to 5 percent once the contribution rate reaches levels higher than the basic rate of 7 percent. Further, in order to reduce the complexity of viewing the problem in a multi-dimensional space, the additional assumption is made that the contribution rate may be negative (i.e., the sponsor can extract the surplus and liquidate assets to repay itself and/or participants). This simple modification ensures that the maximization of wealth objective will now indirectly appear in the average contribution rate. This follows because the maximization of wealth implies that the plan’s funded ratio will be as high as possible. If it is assumed that once the plan’s surplus reaches a certain level the extra surplus will be given back to the plan sponsor, then the plan’s wealth is maximized by maximizing the amount that will be paid back to the plan sponsor (i.e., minimizing the contribution level). The objective will now be to minimize the contribution rate for every level of risk or to minimize the risk for every level for the contribution rate.

Figure 5.2 provides the framework for comparing different strategies, with the plan’s risk depicted on the vertical axis and the average contribution rate on the horizontal axis. The ball in this plane represents a particular investment policy. It is clear from the graph that implementing this strategy implies a certain risk level.
for the plan (i.e., the downside deviation is about 3 percent) and that the expected annual contribution rate, when this strategy is imposed, is around 0 percent. A three-standard deviation equivalent of the downside risk would imply that when the funded ratio is below 100 percent, the respective confidence interval denotes a funded ratio of 91 percent. Further, better strategies are defined as those with either a lower risk level and/or a lower average contribution rate.

Figure 5.2. ALM framework for comparing strategies.
RESULTS

Static Investment Policy

The results of the first strategy will be used as a benchmark to compare the efficiency improvements of the SMART View-Neutral strategy. Figure 5.3 presents the efficient investment static policies for the plan and highlights a frontier that connects different portfolios with minimum risk, given an average contribution rate. This frontier has been created by conducting a hybrid simulation/optimization procedure, which has been described in Boender (1997). Figure 5.3 demonstrates that the plan’s downside deviation risk ranges from nearly 0 percent to about 7.5 percent. The investment policies that have low risk (i.e., the policies with low downside deviation and high contribution rates) have a negligible amount allocated to equities, whereas the high-risk policies allocate the maximum allowable percentage to equities. In addition, the average contribution level over the horizon decreases as the plan’s risk and expected return increases, which is an intuitively reasonable result.

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Boender (1997) optimizes the simulation model in basically two steps. First, thousands of asset mixes \( x \) are randomly generated and evaluated by the simulation model with regard to the contribution rate and the downside risk measure over the nine-year horizon, as specified earlier. Second, a small sub-set of \( x \) is selected, which performs best with regard to the optimization criterion and is located at a minimal critical distance from each other. From each element of this sub-set, a local search algorithm is carried out to identify the optimal asset-mixes. The optimal asset mixes will now form the efficient investment frontier.
SMART View Neutral Investment Strategy

This process is termed the SMART View-Neutral Rebalancing rule, as the simulations are meant to be arbitrage-free; hence, the change in allocation from bonds to stocks, and vice versa, is not based on market factors but rather on solvency. Chapter 9 demonstrates the absurdity of a “Naïve View-Neutral Rebalancing”, as the current TDFs, with the U.S. Department of Labor’s blessing, are shifting allocations based on the age of participants rather than solvency! Generally, a pension plan can experience efficiency gains by changing the asset allocation to a more risky (conservative) portfolio when the plan’s funded ratio
increases (decreases). For example, a simple SMART View-Neutral Rebalancing rule would be of the form:

\[ \text{Equity Percentage at time } t = 15\% + 0.5\times \text{Funded Ratio at } t - 1. \]  

Figure 5.4 allows for a comparison between a SMART strategy and the basic investment policy and shows the conditions under which the dynamic strategy dominates the commonly adopted static strategy. The frontier that represents the dynamic SMART investment strategy connects those policies where the rebalancing rule is being optimized. Figure 5.4 clearly shows that the ability to revise the asset allocation will result in significant efficiency gains in certain regions (A-B). These efficiency gains are apparent for each risk level until a point where the maximum allowable allocation to equity has been reached (B). Since the SMART strategy increases (decreases) its allocation to risk when the plan is most able (least able) to bear risk, risk-taking and hence efficiency are increased over a static investment strategy that may take risk when there is no risk-bearing capacity. In short, it is easy to show how a solvency-based rebalancing policy can do better than the traditional static SAA. The trick lies in specifying a SMART rule to guide the asset allocation.

\[ \text{See Boender (1998) and Krishnamurthi et al (1998).} \]

\[ \text{In a truly dynamic framework, the intercept and coefficient will be time-dependent. In this example, a linear relationship is given between the funded ratio and the allocation to equity; however, these relationships can also be non-linear or discrete.} \]
This case study assumed an initial funded status of 125 percent. These conclusions were also tested for initial funding ratios of 85 percent and 100 percent. The results appear to be relatively robust to the initial point, though the magnitude of the efficiency gain and the points of inflection (e.g., point B) may differ. An interesting point is that in the case of the initial funded ratio of 85 percent, the derivative strategies in Appendix 5.1 end up being too costly for the
expected gains, as the goal is to attempt to ensure a much higher target funded ratio (i.e., 100 percent funded ratio).

**IMPORTANCE OF CORRELATION ASSUMPTIONS**

The strategies are largely driven by the correlation assumptions (Chapter 4), and recent experience has shown that in times of market distress, correlations tend to unity. Hence, such strategies may be risky in the short term, but would be stable if the long-term correlation estimates are accurate. This is why the chapter argues strongly for View-Based Rebalancing of the SAA over and above any View-Neutral allocation changes. This is addressed in greater detail in Chapter 6.

**THE SMARTER SMART VIEW-NEUTRAL REBALANCING**

Cees Dert, when he was employed as Head of ABN AMRO Structured Asset Management, had proposed a more intelligent approach to the same problem.\(^{117}\) He begins by creating a liability-replicating portfolio (along the lines highlighted in Chapter 3) and then makes an intelligent allocation between this portfolio and a risky portfolio based on current solvency. His approach lends itself to more appropriate hedging in times of stress and can also be conducted more frequently than once a year. However, this approach definitely requires the use of liquid futures-based benchmarks and effective swap-based representation of liabilities – otherwise the cost will be exorbitant.

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BACKGROUND FOR SMARTER VIEW-NEUTRAL EXAMPLE

In the Netherlands, when funding declines below 105 percent, the DnB requires immediate corrective action. Here is the background on the case study assuming a Dutch pension plan:

- Initial funded ratio: 110 percent
- Asset mix: 50 percent equity, 50 percent fixed income (5-year duration)
- 1st year return on assets:
  - between -13 percent and +27 percent with 95 percent certainty, expected return 5.2 percent
- Funded ratio after 1 year:
  - between 93 percent and 135 percent with 95 percent certainty, expected return 111 percent
  - Less than 105 percent with a probability of 29 percent

The outcome of the ALM study is liability-driven; but as the assets are managed relative to the MSCI World index (equity) and the Citigroup European Global Bond Index (EGBI) for fixed income, a disconnect is evidenced between the SAA and the liabilities. Liabilities resurface only when the next ALM study is conducted and the asset mix is essentially buy-and-hold until the next ALM study, assuming an annual SAA. This annual buy-and-hold SAA, which is commonplace in the Netherlands, was driven in large part by consultants who did not exercise control for shorter time periods in the simulation model. The question that arises is whether the CIO can benefit from taking liabilities into account in between ALM
studies as well. Figure 5.5 highlights the impact to solvency from the worst scenarios in this ALM model, and Table 5.4 provides additional details of the impact of asset returns and liability returns on solvency.

Figure 5.5. Evaluating the worst funding/solvency scenarios.

<table>
<thead>
<tr>
<th>Funded ratio after 1 year (%)</th>
<th>88</th>
<th>93</th>
<th>95</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset return (%)</td>
<td>-16</td>
<td>-13</td>
<td>-10</td>
</tr>
<tr>
<td>Liability return (%)</td>
<td>4.7</td>
<td>3.7</td>
<td>4.8</td>
</tr>
</tbody>
</table>

In many cases, a bad year is caused by more than a single bad month. What if the asset mix can be adjusted along the way to reduce the funded ratio risk from both
causes? Let us consider a smarter SMART View-Neutral (SMART VN) Rebalancing such that the objective is to maximize return relative to the liabilities, subject to:

- The tracking error limit on the return of assets relative to the return on liabilities (Chapter 3).
- Probability of the funded level dropping below 105 percent.
- CIO to monitor risk and to allocate risk budget relative to the liabilities.

Risk is caused by market exposures (beta) and by active exposures (alpha). In a counter-intuitive way, a passive portfolio with 50 percent MSCI World and 50 percent Citigroup EGBI which used to be considered “safe” is actually risky because of the implied bet relative to liabilities. The SMART rule that follows is quite simple:

1. Invest in the MSCI World and in a stream of cash flows that matches the projected benefit payments (i.e., our Investible Liability Portfolio).
2. At the end of each month, invest a percentage in equities that is proportional with the surplus over 105 percent:
3. Apply the following formula:

\[
\text{Allocation to Equity} = 30\% + 1.5 \times (\text{Surplus}) \quad (5.2)
\]

The intuition is that the CIO invests more in equities when the funded ratio is higher and more in a matching portfolio when the funded ratio is lower, as in the previous example. *This is feasible only if the asset manager explicitly takes account of the liabilities and monitors their value development; hence, the requirement for specification and creation of an Investible Liability Portfolio as*
detailed in Chapter 3. As Figure 5.6 demonstrates, a simple policy such as the one highlighted in equation (5.2) achieves effective results.

Figure 5.6. Comparing smarter SMART View-Neutral to the static SAA.

Figures 5.7 and Table 5.5 validate the supremacy of the smarter SMART over a static SAA, and the amazing result is that the SMART policy has the same expected funded ratio as the traditional mandate, with less volatility.
Figure 5.7. Smarter SMART View-Neutral versus Static SAA – distribution of outcomes.

TABLE 5.5. Smarter SMART View-Neutral versus Static SAA – distribution of outcomes

<table>
<thead>
<tr>
<th>Funded Ratio (%)</th>
<th>SMART View Neutral</th>
<th>Traditional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>111</td>
<td>111</td>
</tr>
<tr>
<td>Lower Bound 95% Confidence</td>
<td>105</td>
<td>93</td>
</tr>
<tr>
<td>Upper Bound 95% Confidence</td>
<td>135</td>
<td>133</td>
</tr>
</tbody>
</table>
The investment policy of the ABN AMRO Pension Fund (AAPF) is determined by the Board of Trustees of the pension fund. Their decisions are expected to reflect a fair trade-off between the interests of all stakeholders in the pension fund. The Board is supported by an investment committee and by the ABN AMRO Pension Bureau. The ABN AMRO Pension Bureau also takes care of the investment policy’s implementation by hiring external asset managers on behalf of the pension fund.

**DECISION PROCESS – STRATEGIC INVESTMENT POLICY**

AAPF’s decision-making process for its strategic investment policy is well governed by all the advisors to the Board of Trustees playing an important role in an annual process which consists of four steps. First, the Pension Bureau, together with the investment committee, prepares the input for an ALM study. Second, after approval of the inputs by the Board of Trustees, the Pension Bureau prepares the yearly ALM study. Strategies analyzed are combinations of a matching portfolio, a low risk portfolio (a return in line with the return of the liabilities), and a return portfolio composed of a variety of risky investment categories. Both static strategic and dynamic investment strategies are evaluated. Third, the results of the study are discussed with the investment committee. They judge whether the selections achieve the Board’s various goals and evaluate
whether the strategies can be implemented. This results in a selection of approximately 10 strategies to be presented to the Board.

The fourth step takes place during an interactive “strategic investment policy workshop.” During this two-hour workshop, only the results of the strategies in terms of impact on funded status, consequences for the sponsor, and indexation ambition are presented. This is particularly relevant for Dutch plans, as pension funds can offer indexed benefits, but only if there is adequate solvency. This implies that the Board of Trustees can really focus on their goals instead of on the policy tool – the investment policy –, ensuring that the Board is not distracted by the need to review the investment strategies themselves. Any prejudice in respect of investment categories or instruments cannot play a role in such a set-up.

During the first workshop in autumn 2007, the Board decided upon an investment policy with a high potential for indexation at the least possible risk. This resulted in a dynamic investment strategy, and the Board also decided to review the strategy on an annual basis. The latter is important because changes in external circumstances can lead to a situation in which the chosen strategy no longer reflects an optimal trade-off between the interests of the stakeholders in the pension fund.
CHARACTERISTICS OF THE DYNAMIC INVESTMENT STRATEGY

The main characteristics of the dynamic strategic investment strategy are:

1. The amount of risk taken in the investment portfolio is dependent on the solvency of the pension fund, i.e., the Board’s risk tolerance depends upon the amount of assets in excess of the liabilities. A clear scheme describes, for each solvency position reflected in the coverage ratio (or funded status), how much needs to be invested in the matching portfolio and how much in the return portfolio.

2. The allocation to these two portfolios is dynamically managed: as the coverage ratio changes over time, the two portfolios need to be adjusted according to the scheme that the Board has decided upon. It implies a physical or synthetic transition from one sub-portfolio to another.

3. The actual coverage ratio is calculated only on certain predetermined dates during the calendar year. Thereafter, the size of the two portfolios is measured to determine whether a transition is required. This avoids excessive trading between the portfolios.

As a consequence of this investment policy, AAPF had gradually reduced risk as of March 2008. As compared with holding a static asset mix with the same expected return, the strategy resulted in a 10 percent point higher funded ratio by the end of 2008.
IMPLEMENTATION IN PRACTICE

In practice, both the return portfolio and the matching portfolio are composed of sub-portfolios which are managed by several external managers: the matching portfolio has sub-portfolios assigned to three different fixed income managers; and the return portfolio is composed of four investment categories, managed by more than 10 investment managers. This implies that a transition from one normal portfolio to another is a complex operational process. Therefore, AAPF hired two rebalancing managers to implement the (potential) periodic transitions. Their role is to devise a clear strategy on how to efficiently implement the required moves between the two portfolios. Depending on criteria such as costs, operational complexity, operational risk, and the remaining portfolio composition, this can result in physical and synthetic transitions, with one or more of the underlying transition managers.

RESULTS

At the end of 2007, the AAPF introduced an innovative decision-making process in respect of their strategic investment policy. This process resulted in the selection and implementation of a dynamic investment strategy where the management of the risks of assets and liabilities are integrated. This, in essence, meant that the pension fund had to steer away from the more traditional asset allocation approach towards a course in which rebalancing occurs with a direct link to the development of solvency and risk tolerance of the pension fund.
In this chapter, two types of SMART VN Rebalancing rules were evaluated: one where the SAA is composed of traditional assets, and the second where the benchmark-replicating portfolio is treated as an asset to replace the traditional fixed income allocation. In both cases, the allocation to “risky” assets was predicated on the fund’s solvency. This will be contrasted in Chapter 9 with a policy where the allocation to risky assets depends on the age on the plan, and the analysis will reveal the extreme danger inherent in such an approach.

This chapter demonstrates that dynamic strategies could be more efficient than static investment strategies, depending on the fund’s current position and the restrictions on asset allocation. Further, it was established that the view-neutral hedging of liabilities can also be very effective.

When asset-liability markets are incomplete, asset-liability strategies will outperform asset-only strategies, and this dynamism can be seen as the delta hedging of the solvency option. Chapter 6 takes this analysis one step further by demonstrating the benefit of SMART View-Based rebalancing of assets, and Chapter 8 extends the analysis by including a case study that incorporates SMART Liability Hedging with SMART Rebalancing and SMART manager allocation.
APPENDIX 5.1 EVALUATING THE IMPACT OF OPTION AND LEVERAGED STRATEGIES

In Muralidhar (2001), Chapter 4, additional strategies were compared to the simple static and dynamic SAA. These included: (i) a static put derivative strategy; (ii) a dynamic put derivative strategy (where the derivative exposure depends on solvency); and (iii) leverage opportunities on the static and dynamic SAA. For simplicity, our report below is restricted to the results of all the strategies in aggregate, and Figure A.5.1 summarizes these results.

The efficient frontiers of the six different strategies are shown. The following conclusions may be drawn from Figure A.5.1 for a given funded status:

1. Imposing a static one-year put strategy does not provide efficiency gains for the pension plan. This approach was adopted by some pension plans largely to the benefit of the investment banks that offered them.

2. The dynamic put strategy could improve the plan’s performance when the total exposure to equity is larger than 50 percent (beyond B).

3. Although the dynamic put strategy can provide efficiency gains for the pension plan, the SMART/dynamic strategy, which allows the asset allocation to be revised from one year to the next, outperforms these option strategies.

4. Leverage results in more investment opportunities and hence expands the efficient frontier. Consequently, investment strategies for more risky utility functions can be optimized by allowing leverage (rather than opting for a constrained sub-optimal allocation).
5. As the total allocation to equity exceeds 50 percent, the leveraged portfolios gain in efficiency. This is a function of the funded ratio and not a constraint imposed in the research.

6. The dynamic investment approach, with the ability to have short positions, offset by compensating long positions, is clearly the most efficient investment approach, regardless of the plan’s risk tolerance level.

For practical reasons, the option strategies that were evaluated have a maturity period of one year. In general, pension plans enter into option transactions with a one-year maturity. Further, the use of options is limited to a long put position on
the domestic equity allocation. An extension of this strategy to international equities could increase the (small) efficiency gains that have been detected with the dynamic derivative strategy. In addition, it could be preferable for pension plans to consider other types of derivatives (e.g., zero cost or exotic derivative strategies). Finally, the cap on total derivatives in the dynamic strategy could be raised above 10 percent, but this is not expected to significantly affect the results. A critical result is that permitting leverage expands the efficient frontier and makes it preferred to the unleveraged case. This happens for two reasons: permitting leverage allows for, first, an increase in expected returns and, second, a greater exploitation of the correlation matrix in a manner different from that described in Chapter 4.

\[118\] For instance, a pay-later derivative has the nice characteristic of the premium payment and the pay-off taking place simultaneously – a feature that could be preferable to pension funds, since the cash flows are conveniently arranged.
The Case for SMART View-based LDI and Rebalancing

“There are basically two types of people. People who accomplish things and people who claim to accomplish things. The first group is less crowded.”

Mark Twain

BACKGROUND

Managing liability risk is the most important aspect of managing pension funds. Recently, even a very innovative client, call them Client X, saw its assets under management dip by 1.4 percent in the first three months of 2009, as an earlier move to protect the fund against falling interest rates instead damaged its returns. The cover ratio dropped three percentage points by the end of March, 2009, to 87 percent on the back of a further fall in equity prices as well as pressure from long-term interest rates. The subsequent decision at the end of 2008 to reduce fixed income allocation from 60 percent to 54 percent, and dilute equities from 20 percent to 17 percent were intended to provide an 8 percent allocation to protection against interest rate cuts; however, this move actually
doubled the fund’s loss, as its returns would have been only -0.7 percent had it not tried to limit potential losses against its liabilities.  

The renewed interest in asset-liability matching is mainly due to the rapid decline in interest rates, which led to an increase in most pension fund liabilities on a mark-to-market basis. Unfortunately for most pension funds, this decline in interest rates coincided with a slump in many stock markets and a waning in the performance of hedge funds and private equity investments. The fall in the value of assets at a time when the value of liabilities was increasing led to a dramatic downturn in the ratio of assets to liabilities. Therefore, it is all the more inexplicable that pension funds were not advised (by asset managers, academics, consultants, etc) to adopt innovative approaches post the collapse of the tech bubble and, as a result, are now scrambling to beef up their balance sheets. One reason for this inertia was probably the allure of the so-called “absolute return strategies” which took on a form of religious fundamentalism. Such distortions may, in large part, have been an attempt to outdo the innovative endowments that loudly professed their ability to outperform markets through alternatives and then derided the folly of those CIOs who were dabbling in plain-vanilla assets or, alternatively, recommended and implemented in their portfolio a blind mechanistic rebalancing to their SAAs.  

The ratio of assets-to-liabilities is often the focus of regulators, CFOs, and pension fund members when they are engaged in estimating whether a pension plan is

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119 Adapted from an Investments and Pensions Europe article. To protect the client’s name, we have withheld the exact date and title of the article.

120 Swensen (2009) and Swensen (2005).
“safe” or solvent, as this ratio indicates the shortfall that must be made up. In times of economic recession, the scope for the plan sponsor to fund pensions is minimal. Nowhere in Europe is this more apparent than in Ireland, the Netherlands, and the United Kingdom where companies are facing the biggest competitive disadvantage due to pension liabilities from sponsoring DB pension schemes (Aon 2009). It is precisely for such troubled periods, when sponsors are faced with the onerous responsibility of topping up the fund, that the pension fund must be smart about designing their static and dynamic strategies. Further, new accounting standards, especially in the United States, imply that pension fund losses can impact the corporate pension fund sponsor. As a result, many pension plans worldwide are adjusting their investment portfolio and hedging strategies to reduce the impact of a declining and volatile funded ratio. Recent attempts by the U.S. Department of Labor to soften the cash flow impact to corporations from the declines in solvency in the United States sets a dangerous trend, as it solves the immediate cash flow problem by dramatically reducing required contributions but, in so doing, threatens the fund’s long-term solvency.

Moreover, as mass-scale production in asset management leads to healthy profits, asset managers are loathe to develop customized solutions for clients, and CIOs are given minimal staff to conduct this essential research themselves. Hence the industry has been poorly served by way of innovative products, leaving it to the CIOs to be the key innovators. This also backs up our recommendation that pension funds are better off hiring good staff than paying high asset management fees to external third parties.

121 An alternative measure is the ratio of Salaries to Liabilities, as it provides an indication of the degree of contribution sensitivity the fund implies. See Muralidhar (2001), Chapter 4.
Up to this point in the book, the stage has been set for the most important process and innovation for ensuring future pension solvency – namely, helping CIOs take advantage of asset price/security (including the ILP) cyclicality in managing the solvency of their funds through effective management of liability hedges and the SAA. It has been clarified that assets and liabilities need to be referenced through the most liquid instruments (Chapter 3) to ensure that they can be tracked daily, but also that they may be allocated into and out of at minimal cost and without friction. The discussion has also provided clear direction as to how pension funds can develop factor-based SMART Rules (Chapter 4). The application of this principle to hedging liabilities intelligently or SMART LDI, as well as SMART Rebalancing or the Beta Engine is now demonstrated. Chapter 8 will address how SMART manager allocation or the Alpha Engine can further enhance the solvency profile of a pension fund, as manager selection and allocation are just another set of decisions to achieve solvency goals. However, the key message is: there is no single product that can solve the problems of CIOs worldwide, and hence our emphasis has been on improving pension fund process that would enable each CIO to design the optimal approach for their fund, given their respective liabilities and objectives.
As shown in Chapter 4, static LDI products are simplistic and naïve and do not achieve the objectives of pension funds. Though the “duration pool” approach may seem appropriate, it is a static approach, unnecessarily utilizing cash when the same exposure could have been achieved by availing of relatively simple derivatives as in the ILP in Table 6.1. Most important, extension of duration is a timing decision and deciding when to hedge and how much to hedge can be a source of additional value and risk management over and above that of a static hedge. Again, one need not be right 100 percent of the time for SMART LDI to be successful but clearly this operation lends itself to the rules-based approach.

Lowering the volatility of the asset-liability ratio by increasing correlation between assets and liabilities is an incomplete objective, as it focuses only on the risk and not on the return differential.

Another piece of new research that is misleading is the fallacy provided in Arnott (2009) where a case is made for investing in 20-year bonds instead of trying to capture the ephemeral equity premium. To quote liberally for fear of misinterpretation, “A 2.5 percentage point advantage over two centuries compounds mightily over time. But it’s a thin enough differential that it gives us a heck of a ride... Stocks for the long run? L-o-n-g run, indeed!... Over this full 207-year span, the average stock market yield and the average bond yield have been
nearly identical. The 2.5 percentage point difference in returns had two sources: Inflation averaging 1.5 percent trimmed the real returns available on bonds, while real earnings and dividend growth averaging 1.0 percent boosted the real returns on stocks... Our research on the Fundamental Index® concept, as applied to bonds, underscores the widely held view in the bond community that one should not choose to own more of any security just because there’s more of it available to us... As investors become increasingly aware that the conventional wisdom of modern investing is largely myth and urban legend, there will be growing demand for new ideas, and for more choices.” How true – except that the new idea is dynamic management of assets, not Fundamental Indexing®! And pension funds need not hire an asset manager to adopt this “new” idea.

TABLE 6.1 The Investible Liability Portfolio (ILP) for a Dutch client

<table>
<thead>
<tr>
<th>Index Maturity</th>
<th>Benchmark Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liability Index 003M</td>
<td>0 %</td>
</tr>
<tr>
<td>Liability Index 006M</td>
<td>10 %</td>
</tr>
<tr>
<td>Liability Index 012M</td>
<td>10 %</td>
</tr>
<tr>
<td>Liability Index 024M</td>
<td>20 %</td>
</tr>
<tr>
<td>Liability Index 060M</td>
<td>10 %</td>
</tr>
<tr>
<td>Liability Index 120M</td>
<td>10 %</td>
</tr>
<tr>
<td>Liability Index 240M</td>
<td>5  %</td>
</tr>
<tr>
<td>Liability Index 360M</td>
<td>5  %</td>
</tr>
<tr>
<td>Liability Index 480M</td>
<td>15 %</td>
</tr>
<tr>
<td>Liability Index 600M</td>
<td>15 %</td>
</tr>
</tbody>
</table>
Not so implicit in Arnott’s paper is a pitch to create a market for bond ETFs – no doubt in the course of being constructed by his “bond-offering heavy” employer. It is surprising that the author did not make the additional leap of faith that, given the duration of liabilities, this could be the perfect hedge for liabilities – injudiciously, the case was made from an asset basis alone. The laxity of the argument is provided by the author himself who shows that, over extended periods, one asset dominates the other – and hence the only take-away for a smart reader is the need to allocate dynamically to assets instead of anchoring their portfolios to the pitfalls of static allocation.¹²²

Extending the duration of a fund may unfortunately be a hollow measure, as the return of the assets has to match, and sometimes even exceed (depending on the funded status), the return of the liabilities; and with yields at the current levels, and the likely prospects of high inflation – in view of the degree of liquidity injection into the system –, long-duration bonds, far from providing adequate returns relative to liabilities, may actually damage a pension fund’s portfolio. Hence Arnott’s (2009) questionable recommendation is startling, considering that he is a fiduciary for his clients in his day job.

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¹²² We thank Hideo Kondo of DIC Pension Fund for sharing this research with us and agreeing with us on the absurdity of the recommendation.
The dilemma in dealing with LDI, in the United States, but also in Japan, is that one has to consider what may be termed the economic liability (or the set of proposed cash flows to be financed) against the funding liability and the accounting liability or the valuation implied by the local regulators. A keen understanding of these parameters is important, as well-intentioned regulation can often have unintended consequences. A case in point is the U.S. corporate pension fund problem which, due to accounting gimmicks, runs the risk of making the AIG bailout look like a walk in the park.

John Osborn of Russell Investments has kindly shared with us his convictions as follows: “There are two key liabilities that DB plans are concerned with – accounting and funding.

“Accounting – The discount rate is set by company management, recommended by the actuary, in accordance with FAS/IAS GAAP guidelines – “High quality corporate curve” generally interpreted to be AA corporates. Each actuary is now recommending their own proprietary interpretation of this. For example, Mercer publishes their Pension Discount Yield Curve and Index Rates monthly on their website. Another actuary has stated that “Barclays Capital Long Aa Credit and the Merrill Lynch High Quality 10+ and 15+ indexes” are most closely correlated with their rate. Historically, many plans used Moody's Long-Term Corporate Bond Yield. A better, more general proxy is the Citigroup Pension Discount Curve and its
related Citigroup Pension Liability Index; sadly, there is no one unique benchmark which all corporate funds can use.

“Funding – With the adoption of the PPA in the U.S., the Internal Revenue Service (IRS) has also moved to a high quality corporate curve. Plans have the choice of a 24-month average “segmented” curve or a “spot” full yield curve (actually a 1-month average). Given the recent debacle to liabilities and what happened to rates in 2008, a new provision allows plans to look back a few months, e.g., for 12/31/08 valuations, plans can look back to October ’08 – thereby providing a huge element of funding relief (but not addressing the long term underfunded situation). The IRS publishes these yields monthly. Many complain that their methodology is not transparent and the resulting curve cannot be replicated in practice.

“During good economic times, companies emphasized accounting measures, in part because many plans were in surplus and generating pension income (non-cash profit and loss items), and were taking contribution holidays. My sense is that the pendulum is shifting back towards cash as funded status has collapsed, and PPA is much more stringent in requiring contributions at a time that companies are cash poor. Many street analysts ignore pension-related income and expense. Some in the industry argue that a Treasury curve should be used to calculate the true economic liability. No plans that I know of do this, and obviously right now this would be extremely onerous.”

Some of the more innovative clients and consultants (e.g., Frank Russell has advised at least one other corporate fund on this approach) provide the CIOs and
the implementation agent (e.g., firms such as The Clifton Group and Russell Investment Group) with a menu indicating the acceptable extent for hedging liability based on the level of interest rates (and possibly credit spreads). While such a stance may, in effect, be successful, it is a bet by the consultant and the CIO on the likely movement of rates once they pass certain thresholds — i.e., it implies a view on the markets.

For example, a hypothetical chart (see Figure 6.1) highlights what such a Marginally SMART LDI operation may resemble and assumes a continuous reaction function whereas, in practice, given the realities of swap transactions, the function may need to be made more discrete. In this SMART approach, the rule specifies clearly how much of the liability should be hedged based on the level of nominal interest rates and credit spreads. As shown in Figure 6.1, when credit spreads are high, a 2.5 percent nominal long term rate implies a 25 percent hedge (red line). When credit spreads are low, to move to the same liability hedge requires a 3 percent nominal rate (blue line).

THE SMART VIEW-BASED APPROACH

Though the previous approach has the merits of simplicity and clarity of action and could be considered a SMART LDI approach, it implies mean reversion of rates and credit spreads in the liability hedge. Further, this chart assumes that hedges will be added and lifted though in real-life implementation there may be a tendency to only increase hedges in the mistaken perception that 100 percent
hedged is the low risk alternative. The analogy to the full currency hedge espoused by the DnB should be obvious. Such an approach is subject to a changing mean, a fluctuating time horizon of mean reversion (much like was demonstrated as an issue with Swensen’s (2005) and (2009) rebalancing approach), and a potential lack of clarity on the particular market factor that is currently spurring the liability hedge.

Figure 6.1. The simple/marginal SMART liability hedge – the US case.

The absence of a clear understanding of risk factors driving the LDI hedge do not allow an over-burdened CIO to be decisive at short notice. SMART LDI would
require a study that defines when extending or shortening duration is preferable to doing nothing, thereby reserving such decision-making only for propitious times. In the detailed factor-based approach, the basis for believing that rates can mean revert is driven by market factors.

Figure 6.2. The SMART IDP – liability matching portfolio as a potential “asset”

Consider a relatively simple liability profile for a Dutch pension fund as highlighted in Table 6.1. For the sake of exposition, Figure 6.2 provides a slightly revised Investment Decision Process (IDP) for the CIO, where every branch in the hierarchy is an opportunity for SMART decision-making. As an aside, this IDP resembles to some degree the PME IDP, but also closely resembles the IDP for the Vervoer Pension Fund (and possibly many other European funds). The only difference across pension funds is likely to be in the weights of each portfolio decision (PD) and possibly the index to which the PD is measured. Two aspects of this chart are highlighted – the first, marked with a red arrow, is the liability hedging box made up of the securities in Table 6.1 at the top level of the IDP. Put differently, a traditional investment policy can be seen as a 100 percent allocation to the SAA and a zero percent allocation to the ILP. For simplicity, assume that the sum of the assets and the liability hedge can exceed the total AUM (i.e., use

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123 Chapter 8 adds external/internal managers to this IDP.
swaps to hedge liabilities and swaps are traded on a notional, rather than a funded basis). The second set of arrows, marked with green at the next two levels of the IDP, are the possibilities for SMART Rebalancing to be applied to enhance the return and the risks of the overall fund – primarily, across the asset class level in the asset portfolio; and secondarily, within the major asset classes.

**TABLE 6.1. SAA for the hypothetical Dutch fund**

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Allocation (%)</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equities</td>
<td>45</td>
<td>Rolled up composite</td>
</tr>
<tr>
<td>- Europe</td>
<td>20.25</td>
<td>MSCI Europe</td>
</tr>
<tr>
<td>- N. America</td>
<td>18.00</td>
<td>Frank Russell 1000</td>
</tr>
<tr>
<td>- Japan</td>
<td>2.25</td>
<td>FTSE All World Japan</td>
</tr>
<tr>
<td>- Pacific ex-Japan</td>
<td>1.35</td>
<td>FTSE All World Asia ex Japan</td>
</tr>
<tr>
<td>- Emerging markets</td>
<td>3.15</td>
<td>FTSE All World Emerging</td>
</tr>
<tr>
<td>Bonds</td>
<td>40</td>
<td>Rolled up composite</td>
</tr>
<tr>
<td>- Euro government</td>
<td>12.00</td>
<td>Barclays Euro Agg Govt</td>
</tr>
<tr>
<td>- Global credit</td>
<td>12.00</td>
<td>Merrill Lynch EMU Corporate</td>
</tr>
<tr>
<td>- High yield</td>
<td>6.00</td>
<td>Merrill Lynch High Yield II Master</td>
</tr>
<tr>
<td>- European high yield</td>
<td>4.00</td>
<td>Merrill Lynch European High Yield</td>
</tr>
<tr>
<td>- Emerging debt</td>
<td>6.00</td>
<td>JP Morgan Emerging Market Bond+</td>
</tr>
<tr>
<td>Real estate and alternatives</td>
<td>15</td>
<td>Direct Real Estate Index + Global Fixed Income + 1%</td>
</tr>
</tbody>
</table>

The SAA for this hypothetical fund is distributed as shown in Table 6.1. The basic statistics on both the ILP and the SAA (2001-2006) are provided in Table 6.2 and demonstrate that the annualized ILP return was 6.83 percent (with 4.5 percent volatility), exceeding the SAA return of 6.03 percent (with 8.42 percent volatility). Other statistics are included to provide some feel for the distribution of returns (average when positive, average when negative, worst single performance, and the ratio of good-to-bad risk) and the degree of decline in value (maximum drawdown). The table shows that a typical SAA has an enormous drawdown –
something the exigencies of 2008 validated, and hence solvency risk is likely to have a similar profile. Further, the drawdown on the asset portfolio is approximately four times the drawdown of the ILP! What is not provided is the most fascinating statistic: that the correlation of the SAA to the liabilities is zero. This has significant implications for the drawdowns of the surplus.

**TABLE 6.2. Basic statistics for ILP and SAA for the hypothetical Dutch fund (2001-2006)**

<table>
<thead>
<tr>
<th>Performance Summary - Total Period</th>
<th>Annualized Return</th>
<th>Annualized Standard Deviation</th>
<th>Annualized Return-Risk Ratio</th>
<th>Average Return when Positive</th>
<th>Average Return when Negative</th>
<th>Worst 'Single' Negative Performance</th>
<th>Worst 'Single' Negative Performance Occurred On</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio Decision Aggregate D. Liabilities vs Managers : Assets BMK</td>
<td>6.03</td>
<td>6.42</td>
<td>0.72</td>
<td>1.73%</td>
<td>-2.36%</td>
<td>-6.95</td>
<td>06/28/2002</td>
</tr>
<tr>
<td>D. Liabilities vs Managers : Liabilities BMK</td>
<td>6.83</td>
<td>4.51</td>
<td>1.52</td>
<td>1.39</td>
<td>-0.91</td>
<td>-3.33</td>
<td>08/31/2006</td>
</tr>
</tbody>
</table>

Assume that the SAA study was conducted with estimates of the expected returns for 10 years, but typically these studies come up short, as one is not sure where the actual returns may manifest themselves. The fact that the asset and liability returns are this close after the first five years should be cause for jubilation, given the difference in volatilities of the assets and the liability. A naive interpretation of the table would elate some analysts since no case is to be made for dipping in the equity pond, given the drawdown, returns, and volatility.

Therefore, though a typical consultant may be anxious about the return differential between ILP and SAA and deem the 0.8 percent difference to be the required annualized alpha to cover the gap, what is lost in this simplistic objective setting is that, typically, the ILP’s volatility at 4.5 percent is 55 percent of the asset
portfolio’s volatility, indicating that the plan sponsor will have to bear enormous risk – not to mention the other deterrents such as worst single performance, maximum drawdown, ratio of good/bad risk, implying the imminence of a high ALM risk. With everything fixed in terms of choice of assets and liabilities, the only flexible parameter is dynamic allocation.

In this example, a set of rules that had been framed in the year 2005 were applied to the portfolio. For simplicity, assume that decisions are made just once a month at month-end. A more practical and effective method would be to allow for decisions to be made daily, though the SMART Rules may not actually trigger every day – in fact, a smart CIO can design the program to work on their desired frequency. For this example, our surmise of once a month for decision frequency was made on the basis that, at a minimum, pension funds review asset allocation decisions at month-end to act thereafter on cash flows.

The following economic/financial factors are used to help in the decision on whether or not to recommend an allocation to implement a liability hedge (by buying the ILP). Each of the four rules (factors listed below), which were originally used to help with rebalancing across assets, is applied here to show that the factors are not data-mined and will be used across the two key levels of decision-making. By using derivatives to gain liability exposure, “leverage” may actually curtail risk and, as shown in the $M^2$ measure, leverage is beneficial when deployed in the appropriate manner. The four simple factors used to make this decision between whether to hedge or not, are listed below and each is arbitrarily equally weighted at 25 percent to register no further factor data-mining. The

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124 Muralidhar (2005a) and Muralidhar (2005b). The latter describes the dynamic investment process in detail.
resulting analysis demonstrates that exploiting the assumptions underlying the correlation matrix is not rocket science but rather a simple application of economic intuition to asset class performance, and a more detailed factor analysis could easily generate better results.

- **Baltic Dry Index**: Economic activity is measured by shipping of goods across markets, and one measure of shipping activity is the Baltic Dry Index. When this index of global economic activity rises above (falls below) a historic threshold, it tends to be mean reverting. Economic growth tends to be inflationary; hence, one would not seek to extend duration when inflation has the potential to increase.\(^{125}\)

- **Oil**: If the price of oil is increasing, this is typically inflationary and not a favorable indicator for extending duration.\(^{126}\)

- **Seasonality**: During the summer months, investors avoid risk, but at all other times they prefer to opt for risk. For a CIO benchmarked to an SAA (and not the ILP), discard the hedge in the summer and keep it on otherwise.\(^{127}\)

- **Momentum**: For simplicity, use the trend of the 10-year swap index in the ILP as an indicator of the ILP’s general trend. If the performance of fixed income assets shows improvement, allocate to the ILP, otherwise do nothing.

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\(^{125}\) Thanks to Patrick Groenendijk, Roland van den Brink, and Philip Menco for turning me to this statistic as far back as 2003.

\(^{126}\) This is basic economic intuition and a frequent topic of discussion, including in the daily editions of the *Wall Street Journal*.

\(^{127}\) Jacobsen and Bouman (2001). Also known as the “Sell in May and Go Away” strategy (Ned Davis Research).
In Figure 6.4, the resulting allocation to the liability hedge is indicated in green. Notice that the asset allocation to the SAA (blue line) is constantly 100 percent.

Figure 6.4. Historical allocation of the liability hedge (green line).

Table 6.3 demonstrates that each rule individually adds value relative to a “Do Nothing” approach, and combining these four rules in a naive way leads to a strategy (weighted combination of the four rules) that is comfortably diversified. For example, the momentum-based liability hedge is the most effective and generates a 4.06 percent annualized return (for 3.75 percent volatility) versus doing nothing. Equally weighting all four rules provides 2.31 percent annualized excess versus not hedging. To be precise, if three rules say “Do Nothing” and the
fourth says “Full Hedge”, the CIO interprets this as a 25 percent hedge, using the ILP. As more rules click in, the hedge ratio increases. Table 6.3 shows that the results were not optimized, as the annualized return-risk ratio of the strategy is less than that of the best rule and includes the Oil rule even though it performed poorly.

**TABLE 6.3 Value of SMART LDI rules and strategy versus doing nothing**

(2002-2008)

<table>
<thead>
<tr>
<th>PERFORMANCE SUMMARY</th>
<th>Annualized Return</th>
<th>Annualized Std Deviation</th>
<th>Annualized Return-Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Period</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategy Excess</td>
<td>2.31%</td>
<td>2.47%</td>
<td>0.9333</td>
</tr>
<tr>
<td>SMART LDI Oil Excess</td>
<td>0.09%</td>
<td>2.5%</td>
<td>0.0372</td>
</tr>
<tr>
<td>SMART LDI Summer Excess</td>
<td>1.11%</td>
<td>2.01%</td>
<td>0.5493</td>
</tr>
<tr>
<td>SMART LDI Baltic Excess</td>
<td>3.5%</td>
<td>4.02%</td>
<td>0.8691</td>
</tr>
<tr>
<td>SMART LDI Trend Excess</td>
<td>4.06%</td>
<td>3.75%</td>
<td>1.0809</td>
</tr>
</tbody>
</table>

However, if this SMART LDI strategy does not combine well with the SAA, adding value proves inadequate, as ultimately the purpose is to ensure that the sum of all portfolio decisions achieves the solvency goals within acceptable risks. Table 6.4a presents the results of the SMART LDI + SAA (titled “Strategy” in the table) in comparison with the SAA (titled “BMK”) from 2002–2006; and Table 6.4b provides the same comparison for the years 2002-2008. The most critical outcome is that
adding the liability hedge kept the overall volatility unchanged (8.42-8.51 percent, and 7.42-7.54 percent over the two periods, respectively), whereas adding excess returns would potentially enhance the overall solvency from a return perspective. One needs to evaluate how all these parameters compare with the liability and ascertain whether a trade-off has been made between enhanced asset returns and lower correlation to the ILP.

An additional level of sophistication that can be applied to the SMART LDI strategy is to dig deeper into each of the ILP maturity components and then manage the allocations and positions relative to the ILP. Therefore, CIOs or investors with strong capabilities to manage the duration and convexity risk implied in the ILP have the wherewithal to extract additional value from the ILP hedge. For ease of exposition, this idea is not pursued here.

**TABLE 6.4a Performance of SMART LDI strategy versus SAA benchmark (2002-2006)**

<table>
<thead>
<tr>
<th>PERFORMANCE SUMMARY</th>
<th>Annualized Return</th>
<th>Annualized Std Deviation</th>
<th>Annualized Return-Risk Ratio</th>
<th>Cumulative Return</th>
<th>M2 Return</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Period</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMK</td>
<td>6.03%</td>
<td>8.42%</td>
<td>0.7167</td>
<td>32.91%</td>
<td>6.03%</td>
</tr>
<tr>
<td>Strategy</td>
<td>9.5%</td>
<td>8.51%</td>
<td>1.1158</td>
<td>55.36%</td>
<td>9.44%</td>
</tr>
<tr>
<td>Excess</td>
<td>3.46%</td>
<td>2.53%</td>
<td>1.3673</td>
<td>22.45%</td>
<td>3.41%</td>
</tr>
</tbody>
</table>

Comparing the performance of the ILP to that of the SMART LDI strategy, one sees clearly that adding the dynamic hedge allows the portfolio to outperform the liabilities – something a pure LDI strategy would not have achieved, especially if the plan was underfunded to begin with.
It was recommended that the SAA be made dynamic and the dynamism be based on market factors, or alternatively terming this a View-based SAA (after allowing for the View-neutral dynamic SAA in the previous chapter and the SMART LDI).

**TABLE 6.4b Performance of SMART LDI vs. SAA benchmark (2002-2008)**

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Annualized Return</th>
<th>Annualized Standard Deviation</th>
<th>Annualized Return-Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>4.62%</td>
<td>7.42%</td>
<td>0.6220</td>
</tr>
<tr>
<td>Benchmark</td>
<td>2.31%</td>
<td>7.54%</td>
<td>0.3061</td>
</tr>
<tr>
<td>Excess</td>
<td>2.31%</td>
<td>2.47%</td>
<td>0.9333</td>
</tr>
</tbody>
</table>

More important, the dynamism is not intended to keep tracking error low or raise the information ratio, but *ideally to help assets outperform liabilities while increasing the correlation* (and thereby lower the ALM risks). An example of how SMART Rebalancing can be used to improve solvency is provided in the case study. Once again, the rules for SMART Rebalancing were established in the year 2005, and the results post-2005 are out-of-sample.\(^{128}\)

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\(^{128}\) We would like to thank Roland van den Brink (PME and Mn Services) and Patrick Groenendijk (formerly with PME and currently with Vervoer) for their assistance in this analysis.
As in the SMART LDI portion of this analysis, the following economic factors were converted into rules. Again, little more than economic intuition was applied to this analysis, and hence this is well within the realm of the average CIO.

- **Baltic Dry Index**: When this index of global economic activity rises above (falls below) a historic threshold, it tends to be mean reverting. Economic growth (recession) tends to benefit stocks (fixed income), and hence one would invest in stocks (bonds) when global economic activity improves (declines).

- **Oil**: If the price of oil is increasing, this is typically bad for stocks (bonds) relative to bonds (stocks) and vice versa.

- **Seasonality**: During the summer months, investors avoid risk, but at all other times they prefer risk. It has been shown that in 37 out of 39 countries, the seasonality rule of avoiding stocks in the summer is profitable.

- **Dividend Yield**: Research has shown that investors favor stocks when dividend yields are high and vice versa. Here, only the S&P 500 and Eurostoxx dividend yields are used as indicators.

- **P/E Ratio**: When the P/E ratio is low, the market is undervalued and vice versa.\(^{129}\)

- **Fed Model**: When the yield of stocks is greater than the yield of bonds, favor stocks and vice versa.\(^{130}\)

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\(^{129}\) Campbell and Shiller (1998a).

\(^{130}\)
Table 6.5 reports the excess return of each rule individually, along with its tracking error and then does the same for a strategy that equally weights each rule at 100 percent, indicating that if one rule says overweight stocks by 1 percent and another says overweight bonds by 1 percent, then the two cancel each other out and the portfolio is maintained at benchmark. Again, the combination of many simple rules adds value, as does each idea individually. The fact that the post-2005 results are out-of-sample is evidence of the durability of good economic intuition when combined with SMARTs. The order of magnitude here is much smaller than in the SMART LDI case because most funds restrict the policy ranges around the SAA to no more than +/-5 percent. As a result, the room to maneuver is limited. However, Muralidhar and Muralidhar (2009) have shown, from an asset-only perspective that clients are opting for higher absolute risk by restricting the rebalancing policy ranges – this point having first been made by Barrett (2006) and supported actively by Allan Martin of New England Pension Consultants as the correct way to manage a pension fund.

PUTTING IT ALL TOGETHER – CAN ONE TRULY IMPROVE SOLVENCY?

The previous sections have attempted to show, in fragments, how SMART LDI adds value relative to the SAA as does SMART Rebalancing. The economic factors and SMART Rules utilized to elucidate the case had been set back in the year 2005; hence, even with simple examples, the out-of-sample results have been

\[130\] O’Higgins (1999).
astounding and durable. Though one may criticize this approach for generalizing based on a simple case study (as these rules could have easily underperformed over a different time window), the emphasis is on process rather than specific factors.

**TABLE 6.5 Performance of SMART rebalancing vs. SAA benchmark (2002-2008)**

<table>
<thead>
<tr>
<th>Strategy/Excess</th>
<th>Annualized Return</th>
<th>Annualized Std Deviation</th>
<th>Annualized Return-Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy Excess</td>
<td>0.43%</td>
<td>0.45%</td>
<td>0.9611</td>
</tr>
<tr>
<td>LDI: EQ vs FI - Dividend Yield Excess</td>
<td>0.03%</td>
<td>0.05%</td>
<td>0.517</td>
</tr>
<tr>
<td>SMART LDI: EQ vs FI - Fed Model Excess</td>
<td>0.11%</td>
<td>0.19%</td>
<td>0.5498</td>
</tr>
<tr>
<td>SMART LDI: Eq vs FI - Summer Effect Excess</td>
<td>0.07%</td>
<td>0.12%</td>
<td>0.5586</td>
</tr>
<tr>
<td>SMART LDI: EQ vs FI - Oil Rule Excess</td>
<td>0.13%</td>
<td>0.13%</td>
<td>1.0587</td>
</tr>
<tr>
<td>SMART LDI: EQ vs FI - P/E ratio Excess</td>
<td>0.03%</td>
<td>0.13%</td>
<td>0.2307</td>
</tr>
<tr>
<td>SMART LDI:EQ vs FI-Baltic Dry Index Excess</td>
<td>0.07%</td>
<td>0.13%</td>
<td>0.5332</td>
</tr>
</tbody>
</table>

As has been pointed out from the opening chapters, the intrinsic value is the implication for the solvency of the pension fund. Hence, in this section all possible strategies are directed to the most vital benchmark – the liabilities. The parameters by which the efficacy of each of the strategies will be gauged have
been highlighted in Chapter 3 and, for simplicity, assume that the current funded status is 100 percent and raise the question – given the current funded status (which is generous), and the historical annual growth in surplus and its volatility, what is the probability of the funded status exceeding 105 percent at the end of a calendar year?

After a brief overview of the various approaches, Table 6.6 summarizes all the results from an ALM perspective. Interestingly, when the same rules and principles are applied to the Vervoer Pension Fund (with updated data through April 2009), with no additional customization for different benchmarks, the conclusions are confirmed, thereby validating this approach for a broad swath of pension funds in the Netherlands (at a minimum) and in other countries too. Transaction costs are ignored because the degree of annualized turnover indicated by any of these strategies is trivial, as compared with the value they add. Moreover, many of these strategies are implemented by using exchange-traded futures which have the greatest liquidity and transparency, and lowest cost-to-trade, as indicated in Chapter 3.

- **Static Asset Allocation**: This is merely the constantly rebalanced asset portfolio.
- **Add SMART LDI**: This is the SAA with the View-Based SMART LDI hedge overlay.
- **Add SMART Rebalancing**: This is the SAA with the SMART LDI hedge overlay combined with a restricted (in terms of ranges) form of SMART Rebalancing.
o Annual Rebalancing: For comparison the SAA is allowed to drift intra year, as per the recommendation of many ALM consultants in the Netherlands.

o Three Percent Range Rebalancing: Another alternative, common in other countries in the Anglo-Saxon world and Japan, is to set ranges around the SAA and allow the portfolio to drift until a range is hit and then the assets are rebalanced back to the SAA weights.

**TABLE 6.6 The solvency perspective – comparing all strategies (2002-2008)**

<table>
<thead>
<tr>
<th>Case</th>
<th>Solvency growth (%)</th>
<th>Volatility (%)</th>
<th>Correlation of portfolio with liability</th>
<th>Drawdown of Surplus (%)</th>
<th>Confidence in skill (%)</th>
<th>Success ratio (%)</th>
<th>Prob. funded ratio &lt; 105% at the end of 1 year (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a. Static SAA</td>
<td>-2.69</td>
<td>9.73</td>
<td>-0.27</td>
<td>-28.45</td>
<td>20.2</td>
<td>49.37</td>
<td>78.54</td>
</tr>
<tr>
<td>1b. Add SMART LDI</td>
<td>-0.04</td>
<td>8.53</td>
<td>-0.11</td>
<td>-24.31</td>
<td>40.91</td>
<td>55.7</td>
<td>72.27</td>
</tr>
<tr>
<td>1c. Add SMART rebalancing</td>
<td>0.02</td>
<td>8.55</td>
<td>-0.05</td>
<td>-23.12</td>
<td>45.89</td>
<td>56.9</td>
<td>71.99</td>
</tr>
<tr>
<td>2. Annual rebalancing</td>
<td>-2.51</td>
<td>9.41</td>
<td>0.01</td>
<td>-27.57</td>
<td>21</td>
<td>50.63</td>
<td>78.76</td>
</tr>
<tr>
<td>3. 3 percent range rebalancing</td>
<td>-2.65</td>
<td>9.73</td>
<td>-0.02</td>
<td>-28.42</td>
<td>20.54</td>
<td>50.63</td>
<td>78.41</td>
</tr>
</tbody>
</table>

Different conclusions may be derived from a tabulation of so many figures. The most interesting statistics are presented and the keen reader is left to discern others. The best outcome for each category is shaded in grey. Recall that here the focus has been exclusively on SMART View-Based Decision-making whereas a creative client will take the best of SMART View-Neutral LDI, View-Based LDI, and Rebalancing to truly optimize the fund’s results.
o The average SAA is poorly correlated with liabilities. This has been the greatest pitfall of ALM in recent years, and experience has shown that no amount of dynamism can rectify a poorly designed SAA.\(^{131}\)

o Adding successive layers of SMART decision-making where portfolios are already dynamic increases the likelihood that a portfolio will outperform its liability benchmark with minimal risk. In the case study, the potential value that can be generated from additional layers of rebalancing within Equities and Fixed Income were not considered and, needless to say, this would further improve the ALM profile.

o Interestingly, SMART portfolios not only have low absolute volatility, but can also help manage surplus volatility. Chapter 8 includes a Japanese case study which allows for dynamic manager allocation and goes the additional step to select SMART Rebalancing rules that have a unique correlation property vis-à-vis the liabilities, providing even more fascinating results.

o The drawdown of the surplus (or the likelihood of a big contribution injection) is minimized by including SMART LDI and SMART Rebalancing (and could be reduced further, once intra-equity rebalancing and intra-fixed income rebalancing are added).

o The success ratio (i.e., percentage of times that the portfolio beats the liability benchmark) is also the highest when SMART LDI and SMART Rebalancing are employed. Interestingly, the success ratio is less than

\(^{131}\) I owe this observation to Lester Seigel.
50 percent in all cases and the fund can still have positive solvency growth.

- In this hypothetical example, the probability of being under the DnB mandated 105 percent funding ratio target (usually in three years but in our case assumed after one year) is the lowest when the SMART LDI and Rebalancing approach is used.

**SUMMARY**

To repeat, pension funds should incorporate many levels of dynamism in managing the assets to improve solvency and this chapter focused on SMART VB LDI and SMART Rebalancing. This chapter has shown how such an integrated approach of SMART LDI and SMART Rebalancing helps in improving solvency and lowering the probability of being under any regulatory thresholds while, at the same time, keeping all emotional and financial risk management parameters at the safest end of all currently implemented rebalancing strategies. Every level of a portfolio IDP qualifies for application for SMART decision-making; hence, adding more layers of decisions can only improve the solvency profile further. The book digresses briefly to discuss risk budgeting and external manager compensation before demonstrating the efficacy of an integrated SMART LDI, Beta Engine and Alpha Engine.
“All animals are equal, but some animals are more equal than others.” George Orwell
“We made too many wrong mistakes.” Yogi Berra

INTRODUCTION

George Orwell’s reference to animals is a favorite quote from contemporary literature, but lest one wonders what its relevance is to finance, this chapter turns at once to the topic of risk budgeting, which has become very popular. Our recent experiences with presentations made at conferences (including a case study at a CFA Seminar in Japan in 2006), analyses conducted for pension funds by third parties (including asset managers and consultants), and even software offered to clients by asset managers and so-called risk management companies, suggest that pension funds (or other investors) may not be getting sound advice. The three areas where current approaches seem to be inaccurate are identified as: (i) conducting risk-budgeting analyses on an asset-only basis instead of helping pension funds budget risk on an asset-liability basis; (ii) focusing unduly on static

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133 See, for example, Gentry (2006), http://www.effas.com/pdf/18th_Joint_Seminar.pdf
134 One could argue that these are risk measurement companies, as they do not advise the investor on the investment decisions that would improve the fund’s risk profile.
external manager allocations instead of allocating risk that is based on the
dynamic decisions made by the fund (allocations to various assets, investment
styles, and then managers) and then which managers allocate to (Waring et al
2000); and (iii) focusing on tracking error as a measure of risk instead of on other
measures such as absolute volatility and maximum drawdown. These
shortcomings have hampered pension plans, causing regulators to question the
ability of pension funds to manage risk.\textsuperscript{135}

The one consistent feature in the extensive literature on risk budgeting and risk
management\textsuperscript{136} is that tracking error is used as the measure of risk relative to a
benchmark. However, this measure is used in its totality as a composite number
without further evaluation of the components of this calculation.\textsuperscript{137} In this
chapter attention is focused on only the tracking error, assuming, for the sake of
the argument, that it is the crucial risk measure, though previous chapters show
this is not always the case.

Chapters 2 and 3 demonstrate that the tracking error is closely connected to the
confidence in skill; hence, the means by which it is generated can have very
different implications for how much confidence an investor has in an investment

\textsuperscript{135} http://www.ipe.com/news/Pension_system_risks_underestimated_DNB_31172.php
\textsuperscript{136} The most notable of these papers would be, in alphabetical order, Arnott (2002); Berkelaar
et al (2006); Blitz and Hottinga (2001); Chow and Kritzman (2001); Grinold and Kahn (1999);
Hammond (1997); Lee and Lam (2001); Litterman et al (2001); Litterman, R. et al (2003); Rahl
(2000); Sharpe (1994); Sharpe (2002); and Sherer and Martin (2005).
\textsuperscript{137} Work has been done on marginal contributions to tracking error as in Muralidhar (2001), but
this still ignores the more important issue discussed here.
manager’s skill.\textsuperscript{138} This chapter explains why smart investors should not be indifferent between two equal tracking errors (assuming excess returns are identical), and indicates that they would do well to instruct their active managers very specifically how to take risk in creating portfolios to outperform benchmarks. This analysis is conducted on an \textit{ex-post} basis, but it is apparent that the results apply easily on an \textit{ex-ante} basis. Also, the additional analyses that are proposed should help investors choose an optimal benchmark, a tracking error target, and a period over which the evaluation is carried out, as these may influence the final result. The entire argument is based on the premise that investors intend to compensate their managers for skill and risk-adjusted performance.\textsuperscript{139} The chapter concludes with a novel proposal to compensate managers on the basis of their risk- and skill-adjusted performance.

\section*{DECOMPOSING TRACKING ERROR}

Assume that an investor has hired a single manager (as extending to multiple assets and multiple managers does not change the results). If the tracking error of portfolio 1 versus the benchmark is defined as the annualized standard deviation of excess returns, its formulation will be as in equation (A.2.2). The justification for this as the appropriate measure for risk when an external manager is

\begin{footnotesize}
\begin{enumerate}
\item Cornell (2008) proposes an alternative measure for skill, but Ambarish and Seigel (1996) is much more elegant and simple (with a clear connection as to why the tracking error is the relative risk measure).
\item Muralidhar (2009a).
\end{enumerate}
\end{footnotesize}
compared to a benchmark is provided most elegantly in Ambarish and Seigel (1996).

Assume that the manager beats the benchmark by 1.5 percent annualized. The annualized information ratio (IR) is equal to the annualized excess return divided by the annualized tracking error [equation (A.2.3)]. Outperformance over a benchmark unfortunately does not tell the investor whether the external manager or mutual fund manager is skillful (Modigliani and Modigliani 1997). Nor does it provide the investor with a measure of confidence that the alpha is generated by skill-based processes. Critical factors involved in answering the luck versus skill question include time, desired degree of confidence, investment returns of the portfolio and benchmark, standard deviation of the portfolio and the benchmark, and the degree of correlation between the two [equation (A.2.4)]. The problem, as pointed out in Chapter 2, is that performance data includes considerable noise, and the more volatile the portfolio and a manager’s excess return series, the greater the noise and, hence, the more time needed to resolve this issue. Appendices 2.1 and 3.1 provide the details of these equations.

**IMPLICATIONS FOR RISK BUDGETING AND PORTFOLIO MANAGEMENT**

For simplicity, our results are presented graphically though it is apparent that the implications for how tracking error is created through the benchmark volatility, the portfolio volatility, and the correlation, and its impact on confidence in skill
can be derived through a series of equations.\textsuperscript{140} Therefore, this section starts with a simple experiment (Base Case) and assumes a 2 percent annualized tracking error, a benchmark annualized standard deviation of 10 percent, and a 2-year track record. This 2 percent tracking error can be achieved by multiple combinations of portfolio volatility and correlation for a given benchmark volatility.

For a given tracking error, Figure 7.1 plots the correlation (left vertical axis and red dots), the portfolio’s volatility (right vertical axis and blue dots), and the confidence in skill (horizontal axis). For every confidence in skill level, there is a single correlation and portfolio volatility combination. As Figure 7.1 shows, an investor who is anxious about the confidence in skill is not indifferent about which portfolio the manager creates relative to the benchmark. This parabolic shape is consistent across all simulations.\textsuperscript{141} A smart investor would require the manager to have a high correlation to the benchmark and, as a result, potentially more volatility than the benchmark. In other words, one’s preference for a manager with this simple objective is path-dependent. The more attractive portfolios have a higher confidence in skill (moving from 82.4 percent to 88.8 percent) and this is the primary method that shows that not all tracking errors are equal. After all, only a naïve investor would choose the portfolio with the lowest confidence in skill, all else being equal.

\textsuperscript{140} Differentiating with respect to various parameters while holding others constant
\textsuperscript{141} The parabolic shape should come as no surprise to those who do the math.
This result has interesting implications for Modigliani and Modigliani (1997), as now an investor who conducts their portfolio normalization for risk adjustment (called the $M^2$) may make a sub-optimal portfolio decision based on skill.\textsuperscript{142} Muralidhar (2000) extended Modigliani and Modigliani (1997) to make a case for creating correlation risk-adjusted performance portfolios ($M^3$) by ensuring that the portfolio volatility is set equal to the benchmark volatility – which, in turn, implies a specific target correlation. \textit{The analysis here suggests that the}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure7.1.png}
\caption{Base case – higher correlation and higher volatility are better.}
\end{figure}

\textsuperscript{142} In fairness, Modigliani and Modigliani (1997) assume that volatility is the measure of risk, and hence they normalize only for volatility of the portfolio relative to the benchmark. But an investor who is worried about relative risk and uses Modigliani and Modigliani (1997) can make a mistake, as leveraging/deleveraging the external manager by using risk-free cash does not change the correlation relative to the benchmark.
$M^3$ approach may be sub-optimal, even though Muralidhar (2001) claims that rankings based on the $M^3$ measure of performance are consistent with rankings based on skill.

For ease of exposition, Table 7.1 highlights four simple simulations to draw attention to the parameters being changed in each simulation and the resulting conclusions.

**TABLE 7.1 Highlights of various simulations**

<table>
<thead>
<tr>
<th>Simulation</th>
<th>Tracking Error (%)</th>
<th>Time (years)</th>
<th>Std. Deviation of Benchmark (%)</th>
<th>IR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Case (Fig. 7.1)</td>
<td>2</td>
<td>2</td>
<td>10</td>
<td>0.75</td>
</tr>
<tr>
<td>Less Benchmark Risk (Fig. 7.2)</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td>0.75</td>
</tr>
<tr>
<td>More Tracking Error (Fig. 7.3)</td>
<td>3</td>
<td>2</td>
<td>10</td>
<td>0.5</td>
</tr>
<tr>
<td>More Time (Fig. 7.4)</td>
<td>2</td>
<td>3</td>
<td>10</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Consider the case where the tracking error is the same, but the simulations have two different benchmark volatilities. The same 4 percent range for the portfolio volatility (5-9 percent versus 8-12 percent) is also plotted. In this example, at low portfolio volatilities (Figure 7.2), the confidence in skill for the 7 percent benchmark volatility is higher than in the 10 percent benchmark volatility case, but
as the volatility increases, the confidence in skill rises to just 87.98 percent (i.e., lower than the equivalent portfolio for the Base Case). As the correlation declines from 1 (at the low end of portfolio volatility), the confidence in skill in the Lower Volatility Case is higher; this continues until the correlation rises beyond a threshold (correlation exceeds 0.992), at which point the confidence in skill is lower than in the Base Case. This case is examined as clients have a choice of benchmark (e.g., in the United States, equity between the Russell 3000 and the Wilshire 5000) for a given tracking error budget, and this analysis again suggests that they need not be indifferent between two benchmarks with similar market coverage.

Figure 7.2. Less benchmark risk – results are ambiguous.
The next case (Figure 7.3) is simple, as an increase in tracking error has the most direct impact on lowering the information ratio. This shows up as an immediate decline in confidence in skill (all else being equal) relative to the Base Case – a situation that is obvious from the skill equation.

![Figure 7.3. Increase tracking error – confidence declines.](image)

The final case (Figure 7.4) is quite trivial, as when time is increased, as is obvious from the skill equation, all else being equal, confidence increases.
In Chapter 2, it was emphasized that investors hiring external managers need to be vigilant about these managers’ skills or they risk paying fees that are disproportionate to the effort put in by the asset manager. One of the provisions of the new Capital Relative Asset Pricing Model was that the principal had to state his/her target risk budget and ensure that the portfolio lay on the appropriate iso-confidence curve. This section set out to show that an investor who focuses on confidence in skill is not indifferent about the manner in which a manager creates
risk relative to the benchmark. For a given tracking error budget, a smart investor would require the manager to have a high correlation to the benchmark and, as a result, potentially more volatility than the benchmark. Therefore, this calls for a re-examination of all previous analyses on relative risk, risk budgeting, and optimal allocation of risk.

Another condition needs to be added to existing research, namely, emphasis on a minimum correlation/volatility of portfolio combination, and a re-examination of the result in this light. This approach assumes that the investor does nothing to modify the volatility and correlation characteristics of the risk-adjusted portfolio (à la the M² and M³). Moreover, increasing the tracking error and decreasing the time have a negative impact on the confidence in skill, whereas the impact of volatility of the benchmark is ambiguous.

To return to the Animal Farm analogy, at the end of the book, one of the pigs emerges from the farmhouse, upright and carrying a whip. The animals have never seen anything more shocking! It goes against everything that they have been taught up to then. Just as it seems that some animal might object, the sheep break into a deafening chorus of “Four legs good, two legs better.”

143 http://www.online-literature.com/orwell/animalfarm/10/
After clarifying how risk budgets need to be allocated to control manager behavior, one is drawn to the subject of appropriate compensation for managers, as inadequate compensation schemes may pressurize managers into taking unintended risks. Recent scandals over pay for executives at financial intermediaries begs the question as to whether fees in the investment management industry adjust appropriately for the risk involved and encourage long-term alignment of interests, leading to the conclusion that, generally, the compensation fees for both investment managers and investment staff do not adequately adjust for skill and risk and are not long term. The three primary fee structures are based on (i) assets under management (e.g., 50 bps per annum on assets under management); (ii) absolute returns (e.g., 2 percent + 20 percent of performance); and (iii) outperformance relative to some benchmark. In the interest of full disclosure, this author receives compensation from clients on a fixed and performance-fee basis – without adjusting for risk – and this factor will be addressed later.

Incredibly, Modigliani and Pogue (1973, 1975) wrote seminal papers on this subject in response to changes in SEC rules on investment compensation. They highlighted the need for performance fees to be adjusted for risk to ensure appropriate compensation and for appropriate regulatory oversight. They proposed and evaluated a few simple fee structures, but a “Google” search for

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The author has worked as a pension fund professional as well as a Managing Director in a mainstream asset management firm and a hedge fund.
more updated proposals shows a paucity of practical recommendations on this topic. Of the numerous theoretical papers on principal-agent fee structures for this industry, the most practical suggestions are given by Raymond (2008) who reports on how the Canadian Pension Plan Investment Board structured fees to attempt to pay only for skill and not luck. In the investment management industry, the principal-agent relationships are pervasive and tiered, providing some useful theoretical ideas, which are however not of practical benefit. Moreover, in the absence of effective risk-adjusted performance measures, risk-adjusted compensation is pointless. It is no surprise then that Modigliani and Modigliani (1997) created a new risk-adjusted performance measure called the $M^2$, which opens the door to a rational discussion on risk-adjusted compensation for investment managers and investment professionals in pension funds, endowments, foundations, asset managers, hedge funds, etc. But, surprisingly, the late Prof. Modigliani did not connect his work on risk-adjusted performance to his work on risk-adjusted compensation, and it is this gap that this chapter attempts to fill.

For simplicity, the discussion begins by assuming fully funded mandates with clearly articulated benchmarks.\textsuperscript{145}

\textsuperscript{145} Seigel (2003) provides a comprehensive overview of benchmarks.
PRINCIPAL-AGENT RELATIONSHIP RECAP

In Chapter 2, it was demonstrated that the asset management industry has many layers of principal-agent relationships, and that often pension fund/endowment CIOs/staff are both principal and agent. Individual principal-agent relationships are analyzed, but the approach here is generic so that the compensation schemes can be stacked and are applicable at multiple levels of a fund.

What exactly are the issues dealt with in the extensive principal-agent literature and do they offer any guidance to the issue of risk-adjusted compensation? When a principal hires an agent and delegates decision-making authority to them, this results in typically asymmetrical information, as the principal does not know if the agent is skilled (or informed, as in theoretical literature) and, more important, whether they are willing to exert the required effort to perform in the best interests of the principal. The agent would have to incur cost to expend the requisite effort and, as the principal cannot observe the effort, they need to find a way to monitor the agent to ensure that the principal’s objectives are achieved.\textsuperscript{146}

In short, the situation is fraught with adverse selection and moral hazard problems as also the need for designing incentive-compatible contracts to encourage optimal behavior, given the asymmetric information and inability to clearly observe effort.

In the investment business, it is assumed that the investor (or asset owner) hires a manager to outperform a clearly specified benchmark because of a perceived

\textsuperscript{146} See Woodbury and Neal (1999) and Das and Sundaram (1998).
comparative advantage in favor of the manager. The asset owner expects the manager to outperform the benchmark within certain risk guidelines (as excessive risk-taking could lead to the loss of capital that does not impact the manager but penalizes the principal). Therefore, typically, the only worthwhile parameter that is reported back to the asset owner is the periodic performance of the portfolio versus the benchmark. This data is used to calculate performance and ex post risk statistics, but the drawback is that performance data is noisy – i.e., it does not clearly demonstrate how much of the performance is truly from skill and not luck (Appendix 2.1). The asset owner obviously wishes to pay the agent only for skill-based performance, but this issue is baffling, as often the number of periods of data needed to make such estimations can be quite overwhelming.\textsuperscript{147}

The theory of optimal contracts, with its focus on absolute risk aversion parameters, exponential utility functions, and convex payoff functions, is much too abstruse for effective and practical application in the investment industry. However, there is a general consensus on the viable structure of fees being a combination of a fixed fee (to cover the costs for the agent) and an element of variable fees (that is linked to the portfolio’s performance). In the interest of simplifying this discussion, the focus is solely on the performance-based component and shows how effective risk-adjusted performance must capture all risks incurred in managing a portfolio while, at the same time providing some indication of skill. Assume that the asset owner selects the correct benchmark for the evaluation of performance and risk, as this is a fundamental tenet of the

\textsuperscript{147} Ambarish and Siegel (1996).
entire argument and was raised by Modigliani and Pogue (1975). The difficulties encountered in evaluating assets that are not easily benchmarked are also addressed.

**BACKGROUND LITERATURE ON RISK-ADJUSTED PERFORMANCE FEES**

The literature on risk-adjusted performance fees appears to be limited to Modigliani and Pogue (1975) and a response from Magrabe (1976). All of the subsequent literature is on main-line performance fees (Davanzo and Nesbitt 1987, Kritzman 1987, Raymond 2008). Schliemann and Stanzel (2008) provide an extensive overview of the entire gamut of performance-based fees and their characteristics (e.g., options such as payoffs, high-water marks, reset periods), review the extensive principal-agent literature, and yet mention risk-adjustment only in passing without developing any concepts, except to state that, “in practice, it would be necessary to use a multidimensional performance measure like the information ratio to control the possibility of increased or decreased risk taking due to performance fee incentives. Simple return measures do not account

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148 Admati and Pfleiderer (1997) examine, theoretically, the use of benchmark portfolios in the compensation of privately informed portfolio managers. They find that the use of a benchmark, and particularly the types of benchmarks often observed in practice, cannot be easily rationalized. Specifically, commonly used benchmark-adjusted compensation schemes are generally inconsistent with optimal risk-sharing and do not lead to the choice of an optimal portfolio for the investor. Moreover, benchmarks do not help in solving potential contracting problems such as inducing the manager to expend effort or trying to screen out uninformed managers.
for this specific problem.” Interestingly, even a recent article by Arnott (2005), which summarizes all the issues relating to performance-based fees, does not make reference to compensation for risk-adjusted performance!

Schliemann and Stanzel (2008) identify the key aspects of performance fee structures, namely, (i) the benchmark, which could be a zero return or LIBOR; (ii) the base or flat fee; (iii) the hurdle rate over which performance fees are paid; (iv) the high-water mark (typical of fee structures that have an asymmetric payoff); (v) the participation rate (or the percentage of profits to be shared with the investment manager); (vi) the resetting period over which any high-water mark may be limited; and (vii) a fee cap. In this chapter, a simple risk-adjusted compensation structure is discussed without looking into high-water marks, reset periods, and caps, but these are addressed in the discussion on extensions.

Modigliani and Pogue (1975) highlight three different fee structures based on (a) assets under management (e.g., 50 bps per annum on assets under management); (b) absolute returns (e.g., 2 percent + 20 percent of performance); or (c) outperformance relative to some benchmark. They quickly reject the first two as irrelevant, as these do not align the asset owner’s interests with the manager’s, as neither one adjusts for risk. They consider two different performance fee arrangements that attempt to adjust for risk.

The first (Plan 1) is of the type used in current practice, where performance is measured by comparing the fund return directly with that of a market index, such as the Standard and Poor’s 500 Stock Composite Index. The second (Plan 2)

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149 This article provides one of the most comprehensive surveys in academic principal-agent literature and current practice in the mutual fund and hedge fund industry.
employs the "market line"-type of risk adjustment usually associated with the CAPM, where performance is measured by comparing the fund return with that of a risk ("beta")-adjusted market portfolio.  

Modigliani and Pogue (1975) note that non-risk-adjusted performance fee plans are beset with problems. Apparently, this was also observed by the Securities and Exchange Commission, who stated in a letter of transmittal to the Institutional Investor Study: “When an adviser is compensated on the basis of total return or return relative to an index having a lower volatility than the portfolio itself, an incentive is created for the manager to assume greater risk. Thus, when incentive fees are present,... (it) appears desirable to eliminate as fully as possible the realization of compensation by investment managers based in part on risk borne by portfolio beneficiaries.”

Modigliani and Pogue (1975) point out that a possible solution to the problem was contained in the same study: “To accomplish this end the Commission intends to give serious and prompt consideration to requiring that incentive fees be based only on volatility adjusted investment returns. Incentive compensation would thus be permitted only on that portion of total investment return that is in

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150 This article leverages the original text extensively to keep the original content intact.
151 Muralidhar (1999) has argued that the traditional CAPM is incorrect because it does not account for principal-agent relationships and is a statement of capital markets and asset pricing when all participants are principals. As a result, any measures derived from the traditional CAPM will be incorrect when applied to agents. Instead, a more general CAPM needs to be derived, based on principal-agent relationships, of which the traditional CAPM is a specialized case. The risk-adjusted measure proposed later in the article would be consistent with the more general CAPM.
excess of what general market movements affecting securities displaying equivalent volatility would produce on an unmanaged basis. Technical methods for basing incentive fees on such risk or volatility adjusted returns were adopted for analytic purposes by the Study. Although the techniques employed are of relatively recent origin, it appears that measures of risk adjusted investment "performance" such as employed in the Study are feasible. Their use, as well as other methods for accomplishing this end that may be developed, can provide appropriate and unbiased methods of calculating managerial compensation that would discourage the assumption of excessive risk in managed portfolios, permit superior advisers to obtain additional compensation and permit the profitable operation of smaller economic units not having access to large and efficient sales organizations.”

Later in this chapter, it will be apparent how Modigliani and Modigliani (1997) achieve this objective.

Modigliani and Pogue also pointed out that, “The Commission, via the 1970 Act essentially has the authority to require risk adjusted measures for incentive fee plans. The Commission now has authority under the Investment Advisers Act of 1940 as amended by the Investment Company Amendments Act of 1970 to determine an appropriate index or other measure of investment performance for

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incentive compensation purposes that reflects the degree of volatility displayed by managed portfolios.”

The Modigliani and Pogue (1975) approach examines both proposals analytically and with the aid of simulation. They argue that the CAPM relates the expected return on a portfolio to its systematic risk as measured by beta ($\beta_p$). That is,

$$E[r(P)] = r(F) + \beta_p \cdot (E[r(M) - r(F)]), \quad (7.1)$$

where $E[r(P)]$, $E[r(M)]$, and $r(F)$ are the expected returns on the portfolio, market index, and riskless bond, respectively. Thus, the realized return during the period can be expressed as:

$$r(P) = r(F) + \beta_p \cdot (r(M) - r(F)) + \bar{\epsilon}_p, \quad (7.2)$$

where $\bar{\epsilon}_p$ is the residual (unsystematic) element of the portfolio return which, under the CAPM hypothesis, has a zero expected return. Realized values of $\bar{\epsilon}_p$ different from zero are evidence of superior ($\bar{\epsilon}_p > 0$) or inferior ($\bar{\epsilon}_p < 0$) investment performance.

Assume that the amount of the performance fee paid to the adviser is directly proportional to the return differential between the fund and the standard, $r(S)$, then the fee paid, $\text{FEE}_p$, is given by:

$$\text{FEE}_p = \delta (r(P) - r(S)), \quad (7.3)$$

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where $\delta$ is the constant of proportionality between the return differential and fee dollars or, in the terminology of Schliemann and Stanzel (2008), the participation rate.

Consider first the non-risk adjusted Plan 1. The comparison standard is simply the market return, $I$. Substituting for $r(P)$ from equation (7.2) and $r(S)$ into equation (7.3):

$$FEE_p = \delta \{(\beta_p - 1)(r(M) - r(F))\} + \bar{e}_p. \quad (7.4)$$

Thus, the performance fee depends on the fund beta and the market risk premium $r(M) - r(F)$ as well as the CAPM performance measure $\theta_p$. The expected fee is given by:

$$E[FEE] = \delta \{(\beta_p - 1)E[(r(M) - r(F))]\}. \quad (7.5)$$

Assuming that the expected market risk premium is positive, the expected fee is an increasing function of $\beta_p$. For "neutral" performance relative to the CAPM standard (i.e., $\bar{e}_p = 0$), the expected fee is positive for funds with $\beta_p$ greater than 1, and negative for funds with betas less than 1. Thus, Plan 1 has a built-in bias in favor of higher risk funds.

The equation shows that the fee variation in Plan 1 has two components: a market term resulting from bias in the performance measure, and a residual term resulting from incomplete portfolio diversification. The market component
increases for beta differentials on either side of \( \beta_p = 1 \). The CAPM, however, gives no indication of how the residual component will vary with \( \beta_p \), if at all.

In Plan 2 the return standard \( (r(S)) \) is equal to the mixture of market index and risk-free rate with the same beta as the fund. Thus, \( r(S) = r(F) + \beta_p^*(r(M) - r(F)) \). Substituting for \( r(P) \) and \( r(S) \) in equation (7.3), one gets the expression for FEE:

\[
FEE_p = \delta \bar{e}_p. \tag{7.6}
\]

Therefore, the expected fee can be restated as:

\[
E(FEE_p) = 0. \tag{7.7}
\]

Thus, under CAPM assumptions, the expected performance fee for all beta values is zero. Thus, non-zero values of \( \bar{e}_p \) will be rewarded or penalized in a consistent manner for the complete range of fund betas.

In summary, Modigliani and Pogue (1975) conclude that the CAPM predicts that Plan 1 performance fees will be biased in favor of higher risk funds. Their model also predicts that the market-line performance standard used in Plan 2 will eliminate the bias and reduce the fee variability over time, particularly for the lowest beta funds. However, they did not arrive at a conclusion as to how best to adjust for risks in measuring performance. Measures of risk-adjusted performance are highlighted to demonstrate how such an approach can be developed. Moreover, Chapter 2 shows that the CAPM is flawed; hence, a need arises for a new risk- and skill-adjusted investment compensation scheme.
Litterman et al (2002) have argued that managers should be controlled by requiring them to take a relatively constant risk, as this would enable the investor to measure their risk-adjusted performance (and their risk-taking ability). Research (Muralidhar 2004) has demonstrated how this approach can be counter-productive, as it may create substandard performance with the manager (agent) being pushed to take risk even when they have information to do otherwise. In other words, it is not propitious to set up damaging instructions for managers when more appropriate risk-adjusted performance measures can be used which, in addition, can help to discern the manager’s skill while not compensating them for blindly increasing volatility (or using leverage) or taking beta bets. Moreover, such investment activities need not be paid for, as they can be conducted costlessly by the asset owner.

Once again, investments with clearly identified benchmarks and funded mandates are emphasized and the chapter will return to more exotic mandates later. Seigel (2003) provides a detailed and helpful overview of benchmarks that are applicable to the typical investor in different asset classes. The skill measure provided in Appendix 2.1 is very different from the typical measure of skill indicated by Grinold (1989), Cornell (2008), and also in Raymond (2008). Raymond (2008) would use just the first term of the proposed skill measure, namely, \[ \sqrt{H[IR(1)]} \]. However, what is important to note here is that while the IR is important, the confidence in skill measure also examines the correlation between the benchmark and the portfolio and the differences in volatility of the two. The
reader can see that the IR, while important for the confidence in skill analysis, will not provide a ranking that is identical to rankings based on confidence in skill.

RISK-ADJUSTED PERFORMANCE REPEATED

In Chapter 3, it was shown how the $M^2$ and $M^3$ are better risk-adjusted performance measures than the Sharpe ratio and Information Ratio (IR). It became clear that the $M^2$ adjustment makes the comparison in terms of basis points of outperformance by ensuring that all portfolios have the same variance as the benchmark. Yet the late Prof. Modigliani did not connect this piece of groundbreaking work on risk-adjusted performance (being estimated in terms of performance) into a fee schedule: now $FEE_p$ could be stated as a proportion of the risk-adjusted excess relative to the benchmark:

$$FEE_p = \delta [r(RAP) - r(B)]. \quad (7.8)$$

Notice here that this approach of risk-adjusted compensation assumes that volatility is the measure of risk, and hence does not compensate managers for naively leveraging the portfolio. The same leverage, if desired by the investor, can be created by the principal relatively costlessly. The informed reader will see similarities in these conclusions with Prof. Modigliani’s innovative work on optimal capital structure (i.e., that an enlightened investor can leverage or deleverage their holding to reverse the deleverage or leverage in a company). The only major shortcoming is that two funds, normalized for the benchmark volatility, could have different correlations with the benchmark, and hence
different tracking errors. It may therefore be concluded that the $M^2$ is the best applicable risk-adjusted performance measure for principals, but not appropriate in a principal-agent situation. Investors would prefer, all else being equal, funds with lower tracking error (and hence greater predictability in returns). Hence, these rankings may provide investors with incorrect information on the relative risk-adjusted performance of funds.\footnote{155}{Equally important, Muralidhar (2001) shows that the $M^2$ measure does not rank funds identically to those based on confidence in skill for obvious reasons, as there is no adjustment for correlations.} 

**COMPENSATING ON THE BASIS OF $M^3$**

Chapter 3 demonstrated why the $M^3$ is probably the best measure for risk-adjusting the performance of external managers who report to a principal with a limited risk budget (or confidence that the manager is skillful). For convenience, the $M^3$ equation is repeated here:

$$r(CAP-1) = a*r(1) + (1-a-b)*r(F) + b*r(B),$$

(7.9)

where the coefficients of each portfolio represent the optimal weight of that specific portfolio to ensure complete risk adjustment, which is then shown to be:

$$a = \frac{\sigma_B}{\sigma_I} \sqrt{(1-\rho_{T,B})\sigma_I^2(1-\rho_{T,B})^{2}},$$

(7.10)

\footnote{155}{In addition, when benchmark returns are negative (e.g., in currency mandates), the $M^2$ measure will incorrectly rank underperforming funds with high volatility as preferable to funds with low volatility. This is a quirk of the method, as it is generally assumed that benchmarks have positive returns.}
\[ b = \rho_{T,B} - a \frac{\sigma_1}{\sigma_B} \rho_{1,B} = \rho_{T,B} - \rho_{1,B} \sqrt{\frac{1 - \rho_{T,B}^2}{1 - \rho_{1,B}^2}}. \]  

(7.11)

A simple example of these approaches is provided in Table 7.2 and taken from Muralidhar (2001) with a target tracking error of 3 percent. For the below-mentioned assumptions on the benchmark and risk-free rate, etc, the target correlation is 0.93, indicating that this 5-star rated Morningstar fund was taking substantial volatility (leverage) and correlation risk.

**TABLE 7.2 Risk adjustment assuming a 3 percent tracking error**

<table>
<thead>
<tr>
<th>Fund</th>
<th>Return (%)</th>
<th>Standard deviation (%)</th>
<th>Correlation to benchmark</th>
<th>D</th>
<th>Tracking error (%)</th>
<th>r(RAP) (%)</th>
<th>R(CAP) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Free</td>
<td>5.5</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Benchmark</td>
<td>17.09</td>
<td>13.27</td>
<td>1.0</td>
<td>1.0</td>
<td>0.00</td>
<td>17.09</td>
<td>17.09</td>
</tr>
<tr>
<td>Active Fund</td>
<td>33.24</td>
<td>27.57</td>
<td>0.71</td>
<td>0.48</td>
<td>20.45</td>
<td>18.85</td>
<td>18.43</td>
</tr>
</tbody>
</table>

Interestingly, under the $M^2$ method, this 5-star fund would have an allocation of only 48 percent, with 52 percent being used to de-lever the fund (since the volatility is double that of the benchmark); and under the $M^3$ method, it would have an allocation of just 15 percent to the fund, a 10 percent allocation to the risk-free rate (implying that the fund had increased leverage as demonstrated by the high standard deviation), and a 75 percent allocation to the benchmark (implying that most of the risk-adjusted return emerged from beta bets). One can immediately see the implications for risk-adjusted performance compensation, and hence the futility of the Morningstar-type ratings.
The advantage in the $M^3$ measure is that it deletes the leverage and beta component from performance for a given risk budget which makes it attractive for a risk-adjusted performance fee, as the investor need not pay managers for activities that they can achieve on their own at minimal cost. In other words, the appropriate risk-adjusted performance fee in the investment industry should be of the form:

$$FEE_p = \delta [r(CAP) - r(B)],$$  \hspace{1cm} (7.12)

where $r(CAP)$ is defined for a given benchmark, tracking error budget, and pre-specified risk-free rate. It has also been shown in Muralidhar (2001) that the $M^3$ performance measure is the only measure among raw performance, IR, Sharpe ratio, and $M^2$ that ranks external managers identical to rankings based on confidence in skill. The intuition for this is that it is the only measure that explicitly adjusts for differences in volatility and the degree of correlation between the investment manager portfolio and the benchmark.

**THE SHARAD MEASURE**

All the performance measures discussed above have a common shortcoming: they assume that the time period of evaluation across various external managers is identical; this is rarely the case, as investment managers have varied inception dates for their products. Muralidhar (2002) combines the $M^3$ equation with the confidence in skill equation to create a new performance measure termed SHARAD (Skill, History and Risk-ADjusted performance) which allows for the comparisons of managers regardless of the length of their track record. This
measure is highlighted in the next section so as not to break the trend in the discussion here. Raymond (2008) makes a similar sort of adjustment where the fees paid for skill are merely a function of time, which could be incorrect if the more appropriate skill measure demonstrated above is used. Figure 7.4 shows how confidence in skill is influenced by additional history.

PRACTICAL IMPLICATIONS OF RISK-ADJUSTED COMPENSATION

It was assumed that managers should be paid a low, fixed fee and demonstrated that the appropriate risk-adjusted performance fee in the industry should be as in equation (7.12), but in reality the fee structures in the industry are asymmetric:

\[
FEE_p = \max\{\delta[r(CAP) - r(B)], 0\}, \quad (7.13)
\]

where \(r(CAP)\) is defined for a given benchmark, tracking error budget, and pre-specified risk-free rate. Raymond (2008) points out that the fixed fee should be proportional to the risk budget, and this is a very sensible recommendation. A key aspect of this discussion is that it is impractical to generalize that, because of this risk adjustment, compensation would be lower than in Plan (1) of Modigliani and Pogue (1975). Muralidhar (2000) demonstrates that in some cases \(r(CAP) > r(P)\) for an investment manager, meaning that under risk-adjusted compensation, managers who are effective at managing risk will be compensated more than if they are paid on pure performance. This may give the creative investor the option of choosing, \textit{ex-ante}, the type of performance fee they would be willing to enter
into with their managers (and the manager’s willingness to enter into such agreements may testify to their true skill).

However, to establish this viewpoint, assume a simple situation where the payment is made at the end of the entire period in a lump sum and the investor (principal) implicitly makes decisions on leverage and beta management of the portfolio. In effect, the \( M^3 \) assumes that enlightened investors conduct their own leverage and beta management overlay independent of their external managers. If such an overlay is not conducted, then, in effect, setting up risk-adjusted performance compensation could lead to problems, as the investor will have to pay the manager potentially more than they actually generated on a risk-adjusted basis.

In addition, in practice, payments to managers are made on a quarterly basis and not at the end of a single period. Typically, these arrangements are also made subject to high-water marks so that the manager is not paid twice for the same performance. In effect, to ensure that this concept is applied on a quarterly basis, the payment to a manager will need to be based on an analysis conducted on a daily basis for the entire quarter, and the calculation will need to be done net of all previous fees (including flat fees) and after accounting for high-water marks.\(^{156}\)

Until now, a single investor compensating a single manager vis-à-vis a very simple benchmark (e.g., S&P 500) had been assumed. However, it is apparent that the same approach could be used by a Board in evaluating an investment staff, as \( r(P) \) is now the performance of the entire portfolio across multiple assets and

\[^{156}\] If investors care to adjust the compensation by the degree of confidence that they have in the managers’ skill, then the performance fee will need to be some fraction of \( r(\text{SHARAD}) \), though this assumes a unique utility function with regard to preferences for risk-adjusted return and confidence in skill. This is an area for future research.
managers, and \( r(B) \) is the return of the entire benchmark for the fund (e.g., 50 percent S&P 500 and 50 percent Bond Index). The advantage in this approach is that the Board can utilize the same approach to risk-adjusted compensation of the investment staff that the investment staff uses to compensate external managers, interweaving a potential alignment of interests at all levels of the fund.

In this portfolio application of risk-adjusted compensation, \( r(F) \) is still the risk-free rate, but here again we assumed a fixed risk-free rate over the entire horizon when, in reality, the risk-free is stochastic. Therefore, the investor and the manager need to be in agreement on how the risk-free rate is measured over a multi-period time frame. In addition, though it appears that the correlation between the portfolio and the benchmark is a static variable that is easily estimated, in reality the correlation is dynamic and drifts over time as new observations are added.

A current feature of the diatribe against Wall Street is that many traders made exorbitant profits in the initial years of a trade, leaving the institution with a worthless asset. The compensation of Lehman Brothers’ CEO is a classic case of meaningful compensation for a company that is now bankrupt! What the above analysis should indicate is that the confidence in skill for an investment with only a year of performance data is rated low, and hence the compensation should have adjusted for this low confidence. Probably, the SHARAD measure needs a few adjustments to hone it into a time- and risk-adjusted tool for risk-adjusted compensation, but the underlying principle, as explained here, offers the framework for an appropriate compensation scheme. In other words, the current loose ends may be secured if risk-adjusted performance fees are not completely

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157 The same can be applied to liability benchmarks.
paid up at the end of every quarter, but rather held in reserve in a separate fund/account to be paid out on the basis of the growing confidence in the manager’s skill, as additional information on confidence in skill is accumulated through the length of the mandate.

APPLICATION TO UNUSUAL INVESTMENT OPPORTUNITIES

At the beginning of this chapter it was assumed that the mandates were fully funded and measured relative to clearly articulated benchmarks (which are representative of the investment opportunity being pursued by the investor and manager). Now, we consider the consequences of the restrictions on funding or clearly articulated (and measured) benchmarks being relaxed. In many cases, endowments and foundations have invested in opaque or illiquid instruments, and this can complicate the application of the risk-adjusted compensation method discussed here.

OVERLAYS AND BENCHMARKS WITH NEGATIVE RETURNS

Many clients implement overlays by using derivatives to capture alpha from currency, tactical asset allocation, and SMART rebalancing. Typically, overlays are largely unfunded (as some cash may be required for margin for futures or settlement of forwards, but these are trivial relative to the notional size for typical
unlevered programs) and are often measured relative to a zero return benchmark or what are deemed as pure alpha mandates. In such a case, the benchmark is zero returns with zero volatility, and the risk-adjusted compensation measure reverts to a standard compensation measure or a fraction of the cash generated from the mandate. In some overlays, such as currency hedging mandates, the benchmark is a portfolio of notional currency forwards, but here the problem is that the benchmark may provide a negative return over long periods of time and, in such a case, both the $M^2$ and $M^3$, if not adjusted, could produce an incorrect result.\footnote{The reason that we ignore negative benchmark returns for funded assets is that a sensible investor would much rather keep their money in cash than invest in an asset with a negative return (unless this provided an unusual source of diversification).}

It has been reasoned that, while a simple index may not exist for currencies, inefficiencies in the currency markets allow for the creation of naïve alpha (or exotic beta) whereby simple rules generate alpha. Examples of such proposals that are served as naïve alpha benchmarks include: favor momentum (buy the currency that went up); buy the currency with the higher interest rate (or the carry trade); buy the currency with the flatter yield curve (a potential PPP trade); and sell short-dated options.\footnote{To understand this comment, compare a portfolio with a negative return to a benchmark which also has a negative return but with a different volatility. Now leverage and deleverage à la $M^2$ leads to unusual results.} It may be suggested that these “exotic betas” or “naïve rules” be the basic benchmark over which performance fees are paid.

\footnote{See Strange (1998), Muralidhar and Neelakandan (2002), and Arikawa and Muralidhar (2007).}
CHARACTERISTIC-BASED INDICES

A recent profusion of indices, modeled on market-based factors instead of capitalization to take advantage of certain inefficiencies, have crept into portfolios. These indices may be regarded as a simple active strategy, and hence the performance of this index should be compared to a standard capitalization weighted benchmark, and the provider of such indices should be paid risk-adjusted compensation. This may lead the providers of such indices to manage risk more actively than would have been possible with the static rules. Investors in such funds would do well to understand the benefit of dynamic management of risk.

HEDGE FUNDS AND FUND-OF-FUNDS

Hedge funds have been the leading target for people wishing to rein in manager fees which have a high fixed fee component (typically 2 percent) and a 20 percent share of returns (typically without reference to any benchmark or risk norm). Hedge funds are not intrinsically an asset class, but rather a cluster of investment strategies with limited constraints with the freedom to leverage, and with negligible relationship to a benchmark (Seigel 2003). Here, it is incumbent on the investor to identify the optimal and relevant benchmark for every strategy, and some banks have created indices that attempt to mimic the performance of certain hedge fund styles such as long-short equity. Clearly, the traditional benchmarks of LIBOR + 5 percent (or T-Bills + 5 percent) are not effective in allowing for risk-adjusted compensation, as the volatility underlying the interest
rate component may not be suited to the creation of an effective benchmark. Two possible solutions are: (i) use a “naïve” passive benchmark along the lines created by the banks; and/or (ii) utilize the asset class benchmark from where this allocation has been carved out, as this is the opportunity cost of making this decision (notice that if the claims about the lack of correlation of these assets to typical beta investments are true, then the investment staff will benefit from the Board holding them to a similar risk-adjusted compensation, as they would have diversified the performance of the overall fund).

In a further twist to the complexities, the fund-of-funds binds many hedge funds together and charges a flat fee and a performance fee in addition to the hedge fund fees. The benefits of this product are often stated to be access to funds that the average investor cannot access,\textsuperscript{160} portfolio construction, and portfolio allocation. As far as we can tell, clients are not provided with adequate attribution of the sources of excess return generated by the fund-of-funds provider – i.e., whether the returns are from strategic allocation, style allocation, manager selection, or manager allocation.\textsuperscript{161} However, once an appropriate benchmark is established for a fund-of-funds (by using, say, a passive investible index), the same attribution technique can be applied, and the fund-of-funds should be paid risk-adjusted compensation only if it has managed to clearly lower volatility while increasing returns without impacting the correlation to a passive index adversely.

\textsuperscript{160} One could argue that this is a bit of a dubious claim if a large fraction of the entire industry claims that access is their key selling point!

\textsuperscript{161} Muralidhar (2005c).
ILLIQUID ASSETS – PRIVATE EQUITY AND REAL ESTATE

While validating the use of this technique for paying compensation to real estate managers who operate in the liquid space, one must note the prevalence of high flat and performance fees is again in the private equity and illiquid real estate area. The drawback with these assets is that either they are not valued frequently, rendering the risk calculations dubious at best, or clients use vintage year indices which are fraught with the same problems. We leave this aspect to future research.

SUMMARY

This chapter set out to throw new light on the subject of risk budgeting, showing that smart investors who are concerned about the skill of managers cannot simply allocate a tracking error risk budget without specific direction to the manager on how they would like that risk to be created. In addition, this chapter highlighted a new compensation structure for agents who are overseen by principals, regardless of whether they are investment staff reporting to Boards or investment managers directed by investment staff. The proposal was to create a norm by which performance fees are adjusted for the risk taken (relative to some clearly specified benchmark), ensuring that investment managers are not compensated for leverage and beta decisions which the principal can achieve relatively costlessly. By utilizing the $M^3$ measure of risk-adjusted performance, we demonstrated how appropriate incentives are created for investment managers to deliver satisfactory risk-adjusted returns for investors. In addition, the same
technique can be used by investment Boards who delegate investment responsibilities to investment staff via a multi-asset benchmark. Since this risk-adjusted performance measure aligns investment outcomes accurately with skill-based rankings, investors can be confident that they are not paying for luck. This new approach, with nuances that will need to be refined over time, is meant to revolutionize the customary pattern of compensating investment professionals and, in so doing, coordinate objectives with investment actions. As Prof. Modigliani and Leah Modigliani commented in 1997, “Yes – you can eat Risk-Adjusted Performance!”
SMART Manager Allocation for Improved Solvency

In Michigan, it is illegal to tie a crocodile to a fire hydrant. 162

All I said was that the trades were stupid and dumb, and they took that and blew it all out of proportion. Ron Davis 163

BACKGROUND

What is the need for alpha from security selection? If the client can improve solvency by means of SMART LDI and SMART Rebalancing, isn’t that enough? It is apparent from the analysis thus far that a reasonably well-selected SAA (i.e., one with a high correlation to the liability), combined with SMART LDI and SMART Rebalancing, does ensure solvency, even for pension funds that are partially underfunded.

The answer to these questions is quite simple – if investors have sufficient faith in their abilities to hedge the liability index and rebalance the portfolio effectively, then the case for active alpha from security selection is quite weak, especially given the operational headaches (custody, transition, monitoring, etc.) and costs

162 Hyman (1992).
163 Petras (2001), page 58, citing Ron Davis, Minnesota Twins pitcher, commenting on press reports mis-quoting his criticism of team managers’ trading top players.
that accompany the search for alpha. However, if the success ratio is adequate and the investor is confident of the potential of adding alpha from security/manager selection (as there may be regulatory, market, or index-based inefficiencies\(^{164}\), then this layer of alpha may be a means of diversifying further with the aim of outperforming the liability benchmark. The sourcing of excess returns from liability, beta, and alpha decisions is not mutually exclusive. Specifically, in the current market environment, where naïve hedging of the liabilities may raise the correlation but do nothing to bridge the return differential between the liability and the LDI hedge, manager alpha gains significance.

Crocodiles tied to hydrants...sound strange? In a similar vein, managers who are hired by investors and then tied to specific benchmarks and portfolio structures may lead to flouting the laws of effective portfolio management. One would expect that the aspect of overseeing external managers in asset management may not have been impacted dramatically by market changes, but this has not been the case. Considerable discontent spread among CIOs in 2008 when many “alpha” managers did not deliver excess returns relative to their benchmarks, and many so-called alpha managers were accused of delivering only beta. Instead of arguing whether managers deliver alpha or beta, or whether portable alpha programs are the way forward or should be trashed, we offer a much more proactive approach to external manager programs. As argued in previous research (Muralidhar 2005c and Muralidhar and Muralidhar 2005), the success of CIOs and even fund-of-funds (FoFs) lies less in manager selection and more in the

\(^{164}\) See Muralidhar (2001), Chapter 12.
three tenets of successful real estate investments: Allocation, Allocation, and Allocation.\footnote{Muralidhar (2005a).}

In the context of managing FoFs, the three key allocation decisions are the decision to (i) strategically allocate to various hedge fund styles; (ii) tactically allocate across hedge fund styles; and (iii) dynamically allocate to individual managers. In the final reckoning, the activity where most FoFs are currently spending their time, namely, manager selection, will end up being a mug's game, as little is proprietary in manager selection. At the same time, getting the three allocation decisions right may need a fair amount of proprietary knowledge, and resulting in returns, for which clients should be glad to pay additional fees. The same norms are applicable to CIOs of pension funds and the dynamic allocation to external managers.

Active versus passive management has been a subject of common debate (Muralidhar 2001, Chapter 12) and, more recently, focus has been on separating alpha from beta (Callin 2007; Brown 2009\footnote{Brown (2009)}); but, again, since the customary measures of performance have been very naïve (e.g., outperformance relative to a benchmark without appropriate adjustment for risk or information ratio), pension funds globally have registered poor performance. Those focused on multi-manager portfolios, including Muralidhar (2001, Chapters 11 and 12) and Brown (2009), discuss multi-manager portfolios for a given risk budget or a comparison of active managers to passive benchmarks over a static window and, regrettably, on static allocations to managers. Further, the problem is compounded by active managers including beta bets in their portfolios and, since

\begin{thebibliography}{9}
\bibitem{Muralidhar2005a} Muralidhar (2005a).
\bibitem{Brown2009} Brown (2009).
\end{thebibliography}
performance measures do not separate the two, when beta declines – as it did in 2008 – manager performance slows down as well. The most glaring example of this poor performance was in the “hedge fund” space, where managers were supposed to outperform cash, but instead dipped over 15 percent on average, indicating a serious tilt to a long beta position. Even the FoFs, supposedly designed to help investors by tapping into the access and investor acumen of investment professionals, who then exacted a heavy fee, could not provide protection to the end investor. In short, had investors or FoFs applied better measures of risk-adjusted performance (and managed portfolios on that basis), combined with dynamic manager allocations, they might have saved themselves from marked underperformance and sizable fees.\textsuperscript{167}

Muralidhar (2001) acknowledges that a case could be made for dynamic manager allocation, and Muralidhar and Tsumagari (1999) had proposed such a proactive approach for currency managers. The latter ran their program on a paper basis, but unfortunately never implemented this approach.\textsuperscript{168} Recent advances in capabilities of managers, better transparency of positions, and even academic research (Avramov and Wermers 2006) point us in a new direction.\textsuperscript{169} This chapter makes the additional leap in innovative approaches to suggest (i) a multi-manager selection process that maximizes fund level alpha generation for a given risk budget; (ii) disregarding the marketing pitches of “Separating Alpha from Beta”; and (iii) ensuring that dynamic allocation to managers is effective from an

\textsuperscript{167} In the case of hedge funds, we have heard from many FoFs that they need to give up liquidity (i.e., shut down programs with manager) and had to allow the managers to install gates.

\textsuperscript{168} Muralidhar and Tsumagari (1999).

\textsuperscript{169} Avramov and Wermers (2006).
ALM perspective. This chapter focuses briefly on currency programs as an easy alpha source, as, globally, few investors have availed of this source of alpha (and the results derived herein apply to other overlay programs that is advocated for pension funds).

**TRADITIONAL APPROACH**

The industry has evolved over time from portfolios where manager allocations were determined by the SAA to a total separation of the alpha and beta decisions.

**ALPHA LINKED TO BETA**

As mandates to managers mimicked the SAA, alpha or excess returns were based on the SAA. In other words, if 30 percent of the fund was allocated to Domestic Equity, then 30 percent was allocated to managers in this bucket, and an attempt was made to extract alpha from these mandates without regard to whether this asset class was the most attractive for the purpose (or whether dynamic allocation made sense\(^\text{170}\)). Moreover, detailed analyses were conducted on the issue of whether or not external managers in these asset classes outperformed benchmarks, as this was the basis for being active versus passive in any asset class (Muralidhar 2001, Chapter 12). In such analyses, typically, asset classes with

imperfect benchmarks, or investment opportunities that were impacted by strange regulatory inconsistencies, showed the greatest scope for static alpha—e.g., Small Cap Equities in the United States and emerging markets. Asset classes such as international equities had benefitted from a one-time historic bet on the weight of Japan in the benchmarks and, once this was corrected for, it appeared that international equity managers did not actually generate alpha on a static basis.

SEPARATING ALPHA FROM BETA:

Since innovative pension managers recognized the inefficiency of the previous approach, as it tied the crocodile to the fire hydrant, “Portable Alpha” came into being, with the earliest usage being attributed to Jack Coates at Weyerhauser and Marvin Damsma at BP America. Under this regime, managers were hired to generate alpha from the most attractive asset classes/opportunities, and beta was created through the use of futures. As Brown (2009) categorizes these opportunities, “Portable Alpha is an organizational structure designed to allow one the luxury of fishing only in those select ponds with the most and easiest to catch fish.” One may dispute the claim of “most” and “easiest to catch”, notwithstanding the major explosion in the use of these strategies by hedge fund FoFs in 2005-2007. Books were written on how clients could port fixed income alpha onto S&P 500-type benchmarks (Callin 2008), but such claims have to be

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read with reservation, as they were espoused by employees at asset management companies who were pitching products instead of information and education. However, the principle of portable alpha that is the most durable is the one that advocates identifying portfolios of excess returns (independent of benchmark, asset class classification, etc) and utilizing creative instruments to introduce them into portfolios.

The two major issues in these portable alpha mandates are: (i) who is managing the beta? And (ii) who is managing the dynamic allocation to the so-called portable alpha managers? \(^{172}\) With regard to the first question, the marketing presentations by managers invariably showed the long-term return of the beta asset to be positive (see also Callin 2007; and Brown 2009), with portable alpha as another positive add-on. What clients did not realize is that by delegating (in many cases) the rolling of the futures contracts to the managers to create beta, the pension funds were taking an implicit bet that beta would always be positive – which was clearly disproved in the global slowdown of 2008. Rolling the futures contracts to create beta was an implicit bet on the market, poorly managed, thereby costing pension funds performance; and, more important, it led to cash margin calls, putting pension funds under stress when the alpha also disappeared.

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\(^{172}\) Muralidhar (2005c).
Chapter 3 demonstrated that Modigliani and Modigliani (1997), in a seminal, though sadly under-utilized approach, revealed the industry’s huge mistake in evaluating managers based on outperformance relative to a benchmark (or even adjusting for risk by using the popular information ratio). In short, they showed how a manager can easily game a benchmark purely by borrowing money and investing in the benchmark asset. Such an operation only increases the portfolio’s volatility and outperforms the benchmark (thereby leading to a positive information ratio) without any skill or effort. This follows because analyses did not appropriately adjust for the differences in volatility before comparing returns.

Moreover, nobody hires just one manager, which raises the challenge of how best to hire and manage a multi-manager portfolio. Most previous commentators, including Waring and Castille (1998), argued that CIOs should hire multiple managers in a portfolio on the basis of a naïve optimization of manager alphas, assuming that maximization of information ratios is the key objective.

Regrettably, all these approaches are still purely static and myopic, as they do not address the CIO’s portfolio needs in targeting the primary goal of ensuring adequate solvency with minimal risk for the pension fund.
INNOVATIVE APPROACH – THE ALPHA ENGINE

In the more eclectic version of managing portfolios, investment strategies are chosen for their multiple properties in enhancing returns while simultaneously improving risk management. As a result, strategies using derivatives are also highlighted.

CURRENCY AS A SOURCE OF PORTABLE ALPHA

Currency overlays, which have been markedly underutilized or obviously misunderstood, are a most valuable source of alpha as (i) the currency market is dominated by non-profit players, providing the perfect backdrop for active management; (ii) it is one of the most liquid markets in the world and trades around the clock; (iii) investment in currency overlays does not require cash upfront – as they are traded using derivatives –, and if these programs are successful, they generate valuable cash for investors; (iv) even simple rules result in profits; hence, the average investor need not even hire an active manager; \(^{173}\) (v) industry track records are long, and a majority of managers have generated alpha which is not correlated to the traditional and non-traditional investment opportunities; and (vi) one can easily attribute outperformance relative to

benchmarks to skill with minimal data.\textsuperscript{174} In a strange twist, the DnB argued that a Dutch pension plan that was applying a dynamic currency hedge ratio vis-à-vis foreign investments (or a Dynamic Beta hedge) was effectively increasing overall risk and thereby needed larger buffers – a decision that was proved to be fatally incorrect when Dutch pension plans incurred meaningful cash flows to settle passive hedges when the Euro collapsed in 2008 against the U.S. dollar and Japanese yen. In a whimsical way, neglecting to exploit the alpha in currencies is tantamount to lending the pension fund’s balance sheet to the market to exploit!

**MULTIMANAGER PORTFOLIOS BASED ON M$^3$**

Muralidhar (2001, Chapter 11) enhanced the manager selection process to show how CIOs could allocate assets on a static basis across all active managers, the leveraging asset (cash), and beta (regardless of whether one is dealing with a single asset or a portfolio composite). In short, the equations for calculating measures of risk-adjusted performance provided in Chapter 3 could be utilized to find optimal allocations to manager, cash, and beta.

Consider $r(CAP)$ for a portfolio of managers ($K$), each of whom is allocated $w_i$, where $r(CAP)$ is the $M^3$ risk-adjusted portfolio return. Utilizing equations (3.1), we obtain:

\[ r(CAP-K) = a*r(K) + (1-a-b)*r(F) + b*r(B), \]  
\[ \text{where } F \text{ is the risk-free rate, } B \text{ is the benchmark, and } r(K) = \Sigma_i w_i^* r_i. \]  
The investors want to select \( a, b, \) and \( w_i \) such that:

\[ \sigma_{CAP-K}^2 = \sigma_B^2 \]  
\[ \text{and} \]

\[ TE(CAP-K) = TE(target). \]

The solution for \( a \) and \( b \), as described in Appendix 3.2 with modification for a portfolio of managers, is:

\[ a = + \frac{\sigma^2_B(1-\rho^2_{T,B})}{\sqrt{\sigma^2_K(1-\rho^2_{K,B})}}, \]  
\[ b = \rho_{T,B} - \rho_{K,B} \frac{(1-\rho^2_{T,B})}{\sqrt{(1-\rho^2_{K,B})}} \]

and \( w_i \) is extracted from the solution to these equations. Muralidhar (2001) highlights a few key points from this approach, the most critical being that it approximated maximized risk-adjusted returns (as opposed to the maximizing information ratios where both the cash and beta asset were permitted investments) and had the highest confidence that performance was skill-based.

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\[ ^{175} \text{Here the terms “benchmark” and “market portfolio” are used interchangeably.} \]
A major area for value-added by pension fund investment decisions that is largely untapped is the value from managing manager allocations on a systematic and dynamic basis. The previous analysis for optimizing manager allocations, beta and leverage points to a static approach, but Chapter 4 has shown that a strong case can be made for dynamic manager allocation decisions (especially since it relies on an analysis of relative return differences). If anything, it is apparent that manager hiring and their allocations are extremely “artful” decisions. Brown (2009) states, “Alpha’s availability is never constant. It is in a continual state of flux – either growing or shrinking. Its status is evolutionary, or in the case of 2008, it was revolutionary.”\(^{176}\) However, Brown (2009) suggests changing managers in preference to dynamic allocations when he states, “Replace a manager when his forward-looking alpha opportunity becomes smaller or disappears. Replace a manager when another manager comes along who has a more attractive forward-looking alpha opportunity.”

Swensen (2005) makes the same mistake as most investors in assuming static manager selection. In reviewing the evidence, Swensen (2005) notes, “In a well-executed study, Robert Arnott, Andrew Berkin, and Jia Ye examine mutual-fund returns over the two decades ending in 1998. The results show that during the twenty years covered by analysis the average mutual fund underperformed the market (as measured by the Vanguard 500 Index Fund) by 2.1 percent per year. The Arnott team’s work provides a \textit{prima facie} case for avoiding active

\(^{176}\) Page 5.
mutual-fund management.” One is reminded of Marion Barry’s comment, “Outside of killings, [Washington] has one of the lowest crime rates in the country.” It must be assumed that the mutual funds under survey must have outperformed their index at some point in their performance cycle, as one cannot accept that any funds could survive 20 years without a single period of outperformance. A dedicated investor needs to find these positive periods, analyze why the manager’s investment process was conducive to such outperformance, and ensure that they allocate to the manager whenever the same factors are in play. This is where SMART rules can be applied to manager allocations.

Swensen (2005) goes further, noting how daunting the task of selecting good managers is, namely, “Only 22 percent of funds in the twenty year sample manage to produce returns that exceed the Vanguard 500 Index Fund result. Even more discouraging for active management may be the slim 1.4 percent per annum advantage garnered by the winners. The overwhelming majority (79 percent) of mutual funds lose ground to the market with losers losing by a greater margin (-2.6 percent per annum) than the margin (1.4 percent per annum) by which the winners win.” Admittedly, this advice is provided in the context of retail investors, though the result is open to question as smart retail advisors can easily be provided a valuable service by focusing not on the averages but rather on the individual managers and when they perform.

Avramov and Wermers (2006) show that it is possible for investors to outperform their benchmarks by allocating assets across managers who individually may not

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177 Page 213.
178 Petras and Petras (2001), page 35.
179 Page 214.
beat their benchmarks. This is done by being smart about when and how much is allocated to a manager (key aspects of a rule), depending on an analysis of market conditions and an evaluation of which manager is likely to benefit from the current environment (or a better understanding of why these managers are not highly correlated with each other or the benchmark). Howell (2004) presents a similar approach to tactical manager allocation in the context of hedge funds and FoFs. In short, Muralidhar’s analysis (2001, Chapter 12) is incorrect because, from Avramov’s and Wermers’s (2006) study it is apparent that, even accepting that managers underperform a benchmark over a long span, if they had a period when they beat the benchmark and the investor had conducted adequate due diligence, then they would have allocated the assets away from the passive benchmark to this manager over the relevant period (and, at an extreme, even shorted the benchmark). The unsatisfactory analysis of manager alpha on a static basis (and hence unproductive recommendations for passive versus active management) is reminiscent of the absurdity of Arnott’s (2009) argument for stocks versus bonds.

The process for making such decisions is identical to the process highlighted for beta, namely, a pension fund could use SMARTs, as shown in Chapter 4 (Figure 4.3 provides an explicit rule). If anything, the problem is more acute with hedge fund FoFs where allocations are not managed because these funds (i) have not focused on such approaches; and (ii) have used hedge fund manager lock-ups and other liquidity options that they forfeited as an excuse. Howell (2004) shows how this process can be conducted in hedge fund space with very few factors making the 2008 experience with FoFs very frustrating. Such omission has cost investors a heavy price (Muralidhar 2009b), as no attribution is made of these actions in
fund-of-fund rankings, and sticky allocations detract from performance when a style is out of favor (Muralidhar 2005b).

A CASE STUDY USING CURRENCY MANAGERS

Given the earlier comments on the currency alpha potential, this section provides a brief case study, using a multi-manager currency portfolio where an investment bank had provided us with data on a series of managers on their platform. The benefit in conducting this analysis on currency managers is that since these programs are run as overlays, allocations can be shifted with minimal notice, cost, and market impact.

A hypothetical multi-manager program was created with the assumption of a static allocation of 12.5 percent of the total notional value to each of eight managers (Figure 8.1). We were provided neither the name nor the investment style of any of these managers – all that was provided to us initially was recorded daily performance data from October 2002 to December 2005.

![Figure 8.1. SMART currency fund structure.](image-url)
The managers’ basic performance and risk statistics, along with the correlations among the various managers, are provided in Tables 8.1a and 8.1b. In short, each manager performed reasonably well (some better than others) and, on a static basis over the period 2002-2007, the static fund had a higher return-risk ratio than the best manager, with a drawdown comparable to that of the best manager. This can be partially explained by the relatively low correlations among the managers but, as pointed out earlier, the low correlations (highlighted in green) also offer the creative investor the potential for developing a dynamic SMART Currency fund. Here the moot question is: which factors could explain return differentials across managers that can be exploited?

### TABLE 8.1a. Currency managers – key performance and risk statistics

<table>
<thead>
<tr>
<th>Name</th>
<th>Annualized Return</th>
<th>Annualized Standard Deviation</th>
<th>Annualized Return-Risk Ratio</th>
<th>Maximum Drawdown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smart Currency Fund</td>
<td>5.64%</td>
<td>3.85%</td>
<td>1.46</td>
<td>-4.76%</td>
</tr>
<tr>
<td>Smart Currency Fund: Portfolio Decision</td>
<td>8.4%</td>
<td>8.5%</td>
<td>0.99</td>
<td>-12.35%</td>
</tr>
<tr>
<td>Smart Currency Fund: Manager 140</td>
<td>0.95%</td>
<td>5.66%</td>
<td>0.17</td>
<td>-8.63%</td>
</tr>
<tr>
<td>Smart Currency Fund: Manager 117</td>
<td>6.90%</td>
<td>15.44%</td>
<td>0.45</td>
<td>-17.34%</td>
</tr>
<tr>
<td>Smart Currency Fund: Manager 102</td>
<td>4.4%</td>
<td>4.43%</td>
<td>0.99</td>
<td>-7.81%</td>
</tr>
<tr>
<td>Smart Currency Fund: Manager 91</td>
<td>8.73%</td>
<td>8.53%</td>
<td>1.02</td>
<td>-12.08%</td>
</tr>
<tr>
<td>Smart Currency Fund: Manager 152</td>
<td>7.95%</td>
<td>8.16%</td>
<td>0.97</td>
<td>-11.03%</td>
</tr>
<tr>
<td>Smart Currency Fund: Manager 138</td>
<td>1.82%</td>
<td>3.31%</td>
<td>0.55</td>
<td>-3.87%</td>
</tr>
<tr>
<td>Smart Currency Fund: Manager 123</td>
<td>3.6%</td>
<td>9.93%</td>
<td>0.36</td>
<td>-17.88%</td>
</tr>
</tbody>
</table>
A simple factor analysis was conducted by utilizing factors that are reasonable for currency managers, and the results of the analysis are provided in Table 8.2. The interpretation of this table is quite straightforward and, as described in Chapter 4 (Figure 4.3), a SMART allocation decision can be made between Managers 102 and 117 using the EUR Implied Volatility data; namely, when the EUR implied volatility is low, allocate away from Manager 117 and allocate to Manager 102. Similarly, every box in the table can be used to develop SMART rules across the various factors. For many manager pairs, several factors provide no information – a not uncommon feature in such analyses.

The factor analysis is converted into a strategy composed of many such rules, and the sample performance is reported in Table 8.3. A static 12.5 percent allocation to all the managers would have generated 7.02 percent annualized returns, whereas the SMART strategy would have added 1.07 percent additional returns (assuming that the shifts could be made costlessly at month-end). The strategy
was not optimized in any way, i.e., no attempt was made to choose rules that lowered absolute volatility and drawdown, but the excess statistics demonstrate that the characteristics of the program are worthy of implementation.

**TABLE 8.2. Factor analysis: Using factors to explain return differentials**

<table>
<thead>
<tr>
<th>Factors/Manager Pairs</th>
<th>117-140*</th>
<th>91-140</th>
<th>91-152</th>
<th>91-102</th>
<th>102-117</th>
<th>91-138</th>
<th>117-123</th>
<th>38-91</th>
<th>38-152</th>
<th>38-140</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUR Option Implied Volatility</td>
<td></td>
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<tr>
<td>JPY Option Implied Volatility</td>
<td>+</td>
<td>+</td>
<td></td>
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<tr>
<td>EMBI Risk Aversion Parameter</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Default Premium</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td></td>
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<tr>
<td>CBOE VIX</td>
<td></td>
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<td></td>
<td></td>
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<td>+</td>
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<tr>
<td>Gold Spot</td>
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<td></td>
<td></td>
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<tr>
<td>US 10 yr to 1 mon Yield Slope</td>
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<tr>
<td>JPY 10 yr to 1 mon Yield Slope</td>
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<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>CBOE Put/Call Ratio</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>EUR/USD Spot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

Running this strategy out-of-sample from February 2006 to January 2007, achieves remarkable results: while the managers registered poor performance caused by the global decline in volatility (as most currency managers are inherently long volatility, as shown in Muralidhar and Neelakandan (2002)),

**TABLE 8.3 In-sample (2002-2005) performance of SMART manager allocation strategy**

<table>
<thead>
<tr>
<th></th>
<th>Annualized Return</th>
<th>Annualized Standard Deviation</th>
<th>Annualized Return-Risk Ratio</th>
<th>Maximum Drawdown</th>
<th>Confidence in Skill</th>
<th>Success Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>BMK</td>
<td>7.02%</td>
<td>4.12%</td>
<td>1.7</td>
<td>-3.3%</td>
<td>N/A</td>
</tr>
<tr>
<td>Strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excess</td>
<td></td>
<td>8.09%</td>
<td>4.69%</td>
<td>1.73</td>
<td>-4.03%</td>
<td></td>
</tr>
</tbody>
</table>

the SMART Strategy performed quite well, adding 1.65 percent excess returns. This performance came with 42 percent annual turnover across managers, i.e., equivalent to a 5 percent shift in allocation for each manager relative to their
initial 12.5 percent allocation. The success ratio of 75 percent indicates the strength of this approach.

**TABLE 8.4 Out-of-sample (2006-2007) performance of SMART manager allocation strategy**

![Performance Summary Table](image)

To summarize, this simple example demonstrates the flaws in the typical portable alpha and optimal manager allocation recommendations, as static allocations are a bet on manager performance with wide scope for improvement. All it takes is a little more effort to examine why correlations across managers/assets are what they are, and then develop a factor-based analysis to formulate SMART rules.

**THE NEXT LEVEL – HELPING IMPROVE SOLVENCY**

To extend the analyses across global investors, a Japanese case study is included starting with a standard Japanese asset allocation and a standard Japanese manager allocation to traditional managers. Though this is at odds with the previous comment on optimal manager construction, this case study provides a
basic variation of a standard portfolio to simplify the entire manager allocation scheme for clients who may find its implementation exacting.

The SAA for this hypothetical Japanese fund, which had been set by the consultant, was 40 percent Domestic Fixed Income, 30 percent Domestic Equity, 10 percent Foreign Fixed Income, 17 percent Foreign Equity, and 3 percent Cash. As described in Arikawa et al (2005), the liabilities had been replicated, using liquid Japanese financial instruments. This section examines how the fund would have performed relative to liabilities for the following operations: (i) static SAA; (ii) range rebalancing, assuming 5 percent ranges around each asset class – typical for most Japanese pension funds; (iii) Simple Beta – developing SMART approaches, but with the goal of generating the highest information ratio from rebalancing decisions; (iv) SMART Rebalancing to improve solvency; and (v) adding SMART Alpha. The goal is to show that applying traditional asset-only approaches (Simple Beta) could leave pension funds short of ensuring optimal solvency. This simulation was set up in 2005; hence, all results post 2005 are out-of-sample (see Arikawa et al 2005).

The annualized liability return (using the technique in Chapter 3) was 2.19 percent over the period June 2003 – February 2009. Against this benchmark, the static SAA would have generated 1.28 percent annualized (or a decline in surplus of -0.91 percent annualized). However, active managers added 0.34 percent annualized over this period for a total underperformance of -0.57 percent.
Figure 8.2. A typical Japanese pension fund – managing alpha and beta to improve solvency.

The range rebalancing option common in Japan perpetuates annualized underperformance of the total asset portfolio relative to liabilities with an annualized deficit of -0.19 percent. Utilization of SMART market-factor based rules to rebalance across the four primary assets, with the goal of generating the highest information ratio, would have generated a deficit of -0.18 percent annualized (as the Simple Beta strategy adds 0.39 percent annualized), as shown in Table 8.5. The Simple Beta strategy was implemented by applying nine rules, and was optimized to ensure the highest information ratio, using the in-sample data.

SMART Rebalancing (Beta) went an additional step and chose only those rules that had the appropriate correlation to the liabilities. As shown in Arikawa et al (2005), SMART Beta management selected only the four rules that had a negative correlation between the excess returns and the SAA. This approach would have had a lower Information Ratio of only 0.88 (in comparison to the Simple Beta
strategy with an information ratio of 1.3). Under the SMART Beta, the rules and their weights were not optimized; but, clearly, just implementing naïve beta strategies or pure TAA strategies is very different from running an Intelligent Beta Strategy relative to liabilities.

**TABLE 8.5 SMART alpha and beta strategy improves solvency (June 2003 – Feb 2009)**

<table>
<thead>
<tr>
<th>Portfolio Analysis</th>
<th>Return (%)</th>
<th>Risk (Volatility) (%)</th>
<th>Correlation with Liability</th>
<th>Volatility of Surplus (%)</th>
<th>Max Drawdown of Surplus (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liability Portfolio</td>
<td>2.19</td>
<td>0.09</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Static SAA (with static manager alpha)</td>
<td>1.62</td>
<td>8.62</td>
<td>-0.01</td>
<td>8.62</td>
<td>-34.27</td>
</tr>
<tr>
<td>Range Rebalancing</td>
<td>1.99</td>
<td>8.57</td>
<td>-0.01</td>
<td>8.57</td>
<td>-33.38</td>
</tr>
<tr>
<td>Simple Beta</td>
<td>2.00</td>
<td>9.18</td>
<td>0</td>
<td>9.18</td>
<td>-35.51</td>
</tr>
<tr>
<td>SMART Beta</td>
<td>2.40</td>
<td>9.29</td>
<td>0.01</td>
<td>9.29</td>
<td>-35.02</td>
</tr>
<tr>
<td>SMART Alpha and Beta</td>
<td><strong>2.45</strong></td>
<td>9.29</td>
<td><strong>0.01</strong></td>
<td>9.29</td>
<td><strong>-34.93</strong></td>
</tr>
</tbody>
</table>

To implement a SMART Alpha process, Arikawa et al (2005) formulated simple manager allocation rules, based on the two foreign equity managers who had been hired by the Japanese pension fund (Managers P and R), using the momentum of the MSCI Kokusai index and market fundamentals. This simple marginal allocation tilt (which could easily be effected by using cash flows that are
required to manage a pension fund) could have generated an annualized 29 bps of additional value within the International equity segment and, in turn, 5 bps at the total fund level. This very simple example, within a single asset class, was highlighted to make the case, and what is shown is that solvency is assured while gradually improving the drawdown. One can easily see the impact of adding value from a systematic rules-based approach to managing all manager allocations in all asset classes.

In this case study (especially since it is out-of-sample), solvency is achieved through SMART Alpha and Beta Management, and the correlation with liabilities is improved marginally, but this is achieved at the cost of higher volatility of the surplus and drawdown, i.e., solvency is achieved, though at the cost of greater risk. The only additional conclusion is that SMART Beta is not the same as the best TAA strategy or the strategy with the highest information ratio. As the potential to add more value from additional SMART decisions across other managers is obvious, it is not pursued further.

**SUMMARY**

This chapter presented a new design for managing pension funds which allows pension fund managers to be smart about managing assets relative to liabilities while, at the same time, allowing them to access alpha flexibly, manage managers dynamically for true alpha, and improve solvency. Developing rules to track market movements and their impact on all beta and manager decisions creates a
systematic process that generates consistent recommendations which are not easily influenced by emotion (though clearly leaving scope for applying informed judgment in the implementation of these rule recommendations).

This chapter showed how optimal risk-adjusted and skill-adjusted performance measures need to be used to extract the contributions of leverage and beta from manager performance. These performance measures are effective because they can advise pension funds on optimal structuring decisions across cash, beta, and multiple managers and, moreover, remain consistent with evaluations of skill. Moving to such an approach also lends itself to dynamic manager allocation. In other words, the goal is to help pension funds meet their ALM obligations through a SMART LDI process, and the lessons of 2008 confirm that SMART Dynamic Management is the way forward.
OFF-TARGET DATE FUND\textsuperscript{180}

There is the joke about a crack marksman who visits a village only to find that the village is pockmarked with bulls-eyes on every wall – with the centers perfectly shot out. He walks into a local pub and asks the bar tender who the person is who is such a perfect shot. The bar tender points to a scruffy looking country bumpkin at the end of the bar. The marksman walks up to the bumpkin and promises him a substantial amount of money if he can tell him how he became such a good shot. The bumpkin takes the money and tells him the answer is simple – he shot first and then painted the bull’s eye around the shot!!

INTRODUCTION

The same could be said about Target Date funds that have pervaded the US, which by some estimates has reached $185bn in assets under management.\textsuperscript{181}

\begin{footnote}
\textsuperscript{180} This chapter would have never been written if it had not been for the incredible amount of time taken and education provided by Karin Brodbeck, Roger Paschke, Charlie Ruffel and Matt Smith.
\end{footnote}
These instruments were sold to individual investors as a panacea for their retirement problems and 2008 revealed the shortcomings of these products. As a result, the DoL has scheduled a series of hearings in June 2009 to review these products. For example, the 2010 target date fund fell on average 24.6 percent (i.e., average across all providers according to Morningstar), which means the investors hoping to retire in the next few years have lost over a quarter of their principal - hardly what one would expect for products that are marketed as, “Simplicity: Pick one fund — your decision’s done; Confidence: Each fund is professionally managed and diversified; Convenience: Each fund is automatically adjusted over time”\textsuperscript{182} The question one has to ask is what is truly meant by “your decision’s done”? what constitutes professional management? And what is the value of “automatic adjustment?”

According to Institutional Investor (2009), T. Rowe Price’s 2010 product returned - 26.7 percent in 2008 (and it is not clear if that negative performance is before or after accounting for fees). The manager of T. Rowe Price’s retirement products is quoted as saying, “2008 is one year out of many,” – small consolation for the 60 years olds who invested in their fund and paid a reasonably attractive fee for the privilege of doing so. Our guess is that other managers are equally culpable in not managing the risks inherent in such products.

The problems in the DC industry are more acute as noted in Swensen (2005): “Serious problems result from forcing individuals to accept responsibility for retirement saving, beginning with lack of full participation in defined-contribution

\textsuperscript{181} Institutional Investor, March 2009, Page 34.
\textsuperscript{182} Manager X – Retirement Date Funds Summary March 2009. We will keep this manager’s name confidential as this article is not about the practice of a single manager but rather of the industry as a whole – this manager being just one of the larger players.
plans. According to a 2001 Federal Reserve Survey of Consumer Finances, more than one of four eligible 401(k) plan candidates chose not to participate. Of these employees that do participate, less than 10 percent made the maximum contribution. When participants change jobs, a distressingly high percentage cash out their accumulated retirement plan assets. Without setting aside the seed corn to begin the asset accumulation process, employees face a bleak retirement harvest.”

This Chapter reviews the current TDF offerings and highlights them in reasonably generic terms. In doing so, the chapter focuses on the many aspects of the design that are poor (or expensive) and risky, and asks whether these risks were adequately disclosed to investors. TDFs were created to serve a specific need – off those who participated in DC schemes, most were not financially savvy and hence made poor investment decisions. For example, many contributors who held company stock ran the risk of losing their savings when the companies went bankrupt. During the technology bubble, many investors in risky technology funds wiped out their pension accumulation. Others invested in stable value funds which did not provide adequate wealth at retirement. TDFs were supposed to be an improvement on these several insecure offerings – helping with the rebalancing to portfolios with less equity as one approached retirement.

This discussion is embellished with an analysis of the impact of the 2008 market downturn on savings and investment behavior. The implication is that products have to be improved and the chapter provides some suggestions for plan sponsors to help participants. It also offers a simple solution to reducing costs by

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183 Page 22.
as much as 0.5 percent per year – this is a straight line improvement to investment returns. It then discusses fees and how fees might be lowered and even how the fee structures should be re-designed to ensure proper alignment of interest given that investors be dismayed to discover 30 years from now that they had been sold a poor product and that their fees cannot be recaptured if the fund provider was either lucky (if they outperform the benchmark) or lacking in skill (if they underperform). The chapter discusses how these funds might be appropriately benchmarked, specifically on a risk and skill-adjusted basis, and how plan sponsors should attribute performance to the various decisions being made by the providers (not always clear to the end participant) to see if they are getting their money’s worth. Sadly, the easiest way to benchmark these funds is on a current performance basis, so an approach that can be applied to give some measure of expected wealth is briefly featured.

At the outset, one must acknowledge that there is no clear academic theory on how individual investors should save and invest to achieve retirement goals (as the problem is too complex); hence, commentators have argued for socializing risks in country pension schemes or replicating DB-like profiles in product offerings through guaranteed real return products (Modigliani and Muralidhar 2004). Interestingly, Ghilarducci (2008) would provide support to the recommendations of Modigliani and Muralidhar (2004), even though she does not acknowledge the prior work on the topic. Therefore, while this chapter is aggressive in its critique of TDFs, the intent is to raise the bar as mistakes in DC plans end up impacting individuals who are the least capable of bearing such risks.
THE TYPICAL TARGET DATE FUND

“We on this side of the House are not such fools as we look” Unknown House member.\textsuperscript{184}

THE BASIC STRUCTURE

For a given “target date” typically restricted to years ending in 0 or 5, the standard fund can be characterized by a starting allocation to a high level asset allocation (stocks, bonds and cash), a glide path (or a predetermined rate of reallocation between equity and fixed income/cash), and a desired allocation at the retirement date. The fund seeks, through these three parameters, to achieve an average allocation that is also pre-specified. Typically, the assumed retirement age is 65.

“Each fund’s asset mix becomes more conservative–both prior to and after retirement–as time elapses. This reflects the need for reduced investment risks as retirement approaches and the need for lower volatility of a portfolio, which may be a primary source of income after retiring. Once a fund reaches its most conservative planned allocation, approximately 30 years after its stated retirement year, its allocation to stocks will remain fixed at approximately 20 percent of assets. The remainder will be invested in fixed-income securities.”

\textsuperscript{184} Petras and Petras (2001) quoting a House member overheard retorting to taunts.
“The allocations reflected in the glide path are also referred to as “neutral” allocations because they do not reflect tactical decisions made by Manager X to overweight or underweight a particular asset class based on its market outlook.”

WHAT THE INVESTOR IS AND IS NOT DELEGATING TO THE FUND MANAGER

A series of risks that these target date fund products engender are summarized in Table 9.1 to indicate how lop-sided the balance is between the participant who bears the risk and the entity to whom the authority to make decisions has been delegated. By virtue of making a single selection of a target date fund, the participant opts for many risks, and this section is intended to highlight such risks to plan sponsors so that they pressure the providers to improve the design of these products.

Objectives: To some degree, the investor is delegating this key decision to the fund manager as the objective of the investor is never clearly examined. Muralidhar (2001) has shown how the optimal allocation (static and dynamic) for DB funds depends on target wealth/replacement rates, initial wealth and risk tolerance (not to mention time). It is also clear from their discussion that the process of making investment decisions in DC plans is identical to that in DB plans, except that DB plans have a longer time horizon and a greater ability to bear risk (because of pooling). The plan sponsor bears some responsibility in helping

185 Manager X Retirement Funds, Prospectus, October 1, 2008.
participants articulate objectives and ensure that correct products are available to satisfy the objectives. The process requires inputs such as: (i) current wealth and desired income at retirement; (ii) target retirement age and expected life post retirement; (iii) assumptions about investments and inflation, resulting in the following output: (a) how much to save going forward; and (b) what return to target. An example of how this analysis should be conducted is provided in Asad et al (1997) and the template for this retirement trade-off calculator is shown in Figure 9.1.

In Figure 9.1, a 25 year old with a starting salary of $50,000 hopes to retire at 65. If they contribute annually 10 percent of current salary (with nominal salary growth of 4 percent), live 20 years post retirement and earn 8 percent returns (with 3 percent inflation), they can receive 72 percent of final salary or 142 percent of average salary, through retirement through death. Alternatively, as the bottom part of Figure 9.1 shows, targeting 100 percent replacement leads to specific recommendations on contributions.

There is nothing in the fund selection process that comes close to highlighting this trade-off between pensions, contributions and investment returns. Asking individuals to select funds based on a retirement date or some arbitrary measure of risk tolerance is fraught with problems, as the link between funds and objectives is weak. The investor makes the fiduciary decision on objectives (which can be implied from the choice of fund, as shown in Muralidhar 2001) but, in effect, is being poorly served and advised by the fund manager and the plan sponsor. Interestingly, Gardner and Fan (2008) discuss the need for providing a comfortable pension and provide a detailed discussion in their paper, but then fall
into the same trap as other providers in their desire to create a “simple, transparent, and consistent” product.

![Figure 9.1. The pension, contribution, and investment trade-off calculator.](image)

**Detailed Sub-Asset Allocation:** Each fund seeks to achieve its objective by investing in a set of underlying mutual funds which represent various asset classes and sectors. In other words, once a fund commits to holding a 50-50 Stock-Bond
mix, how that 50 percent is allocated to international and domestic stocks or value versus growth stock, etc. is a decision delegated to the fund manager, and often the time of allocation of these assets is also delegated to the fund manager, as timing is not pre-specified. Once again, product providers are allowed to take a bet on timing and allocation that must be captured in subsequent attribution.

**Choice of Funds and Fees:** Many providers include only funds that are a part of their fund family, whereas others represent open architecture and include outside manager funds as well. For example, choosing only funds from within a fund family assumes that no other outside fund, on an after-fees and cost, is effective. Moreover, some products use strictly passive funds, whereas others opt for more expensive, active funds. The value of the choice of even passive funds (as there is a choice between replicating a benchmark through futures, passive funds, or ETFs – each with resulting implications for performance and cost) will be examined in detail.\(^\text{186}\) Recently, firms like Charles Schwab have begun to feel the pressure on fees, but even after their so-called reductions, the fees are in the range of 0.61 percent - 0.76 percent. Later, the chapter demonstrates that these fees are exorbitantly high for a simple TDF.\(^\text{187}\)

**Choice of Benchmark Passive Indices:** Closely linked to the above decision is the passive index to which the assets are benchmarked in each asset class. This has implications for cost-effective replication and also potentially the impact/value of

\(^{186}\) Average DC fund fees = 0.72 percent -

http://www.plansponsor.com/pi_type11/?RECORD_ID=45978&page=2

\(^{187}\)

active management. This decision is also delegated to the fund manager by the investor, because of the lack of knowledge or appropriate advice in respect of the impact of this decision. Chapter 3 has shown how pension funds can benefit from selecting futures-based benchmarks; a similar exercise will be suggested later in this chapter.

**Reallocation Process**: Each fund is managed to a specific retirement year (target date) that is typically included in its name (i.e., TDF 2040), and the investor is responsible for choosing this date. Over time, the allocation to asset classes and funds will change according to a predetermined “glide path” (the glide path is the reallocation of asset classes over time). Moreover, two TDFs with the same time to maturity have the same allocation to equity and fixed income. While managers proclaim that this is in the interests of consistency, one could argue that this is not in keeping with SMART VN Rebalancing, as a fund with a 45-year history (with five years remaining) of great performance has greater solvency and risk-bearing capacity than another fund with the same time to maturity but with poor performance. While the glide path is usually prescribed, the prospectus for the average fund gives latitude to the fund manager around the target (e.g., +/-5 percent around the glide path), how this range is utilized within the sub-asset classes, and also the timing of these shifts, and hence investors delegate this too to the fund manager. In the section on attribution, the chapter addresses how the industry should measure and manage such discretion. The prospectus is typically coy with regard to the fact that the fund manager does not deny that they are taking a tactical view on the market in designing a glide path, but only that it is devoid of a market view. It will be shown that the tactical
decision based on age may be a lot more insidious than one that is based on market views, as it is effectively being set up as the investor’s decision, thereby absolving the fund manager of the fiduciary responsibility thereafter (something most individuals would shirk from doing if the facts were presented this way).

Risk management: The fund’s objective and who is responsible for managing risks is not clear, as shown in Table 9.1. The fund does not guarantee any retirement income (or target annuity as a percentage of salary – called the replacement rate). Again, the language of the typical prospectus, vetted by lawyers no less, states that the process of reallocation is intended to satisfy “the need for reduced investment risks as retirement approaches and the need for lower volatility of a portfolio.” However, if bonds perform very poorly close to retirement and are extremely volatile, then the investor has no recourse as their glide path has the investor’s earlier approval. In effect, risk management is now largely the responsibility of the investor, who is making decisions about markets, often 20-30 years in advance, with little knowledge or ability to gauge the risks involved. The claim that this portfolio is conservative is linked to the need for income in retirement without regard to the impact on the value of the principal.

Again, the language in the prospectus in advising investors on how to make investment decisions is noteworthy. “Consider your estimated retirement date and risk tolerance. These funds’ investment programs assume a retirement age of 65. It is expected that the investor will choose a fund whose stated date is closest to the date the investor turns 65. Choosing a fund targeting an earlier date

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188 Manager X prospectus. The prospectus is chock full of language on investment risks – currency risk, duration risk etc, but are silent about not achieving the investor’s goal.
represents a more conservative choice; targeting a fund with a later date represents a more aggressive choice.” One can easily show that these statements are plain wrong.

Table 9.1: The lop-sided nature of risks borne by participants

<table>
<thead>
<tr>
<th>Decision</th>
<th>Risk Borne By</th>
<th>Delegated to</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives at retirement</td>
<td>Participant</td>
<td>Provider is leading Participant to wrong objective with bad products.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plan sponsor needs to bridge the gap.</td>
</tr>
<tr>
<td>Asset allocation over time</td>
<td>Participant</td>
<td>Provider, with no recourse if participant’s true objective (comfortable pension) is not met.</td>
</tr>
<tr>
<td>(formal glide path)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rebalancing around glide path</td>
<td>Participant</td>
<td>Provider, with no recourse (e.g., refunding fee) if this action detracts value.</td>
</tr>
<tr>
<td>Detailed sub-asset allocation</td>
<td>Participant</td>
<td>Provider again, with no recourse to fees paid if such selection is poor.</td>
</tr>
<tr>
<td>Choice of funds and fees</td>
<td>Participant</td>
<td>Plan Sponsor can choose among different vendors.</td>
</tr>
<tr>
<td>Choice of benchmark passive</td>
<td>Participant</td>
<td>Plan Sponsor, but not really clear if they can exercise much discretion,</td>
</tr>
<tr>
<td>indices</td>
<td></td>
<td>given the service provider’s goal to provide products in bulk.</td>
</tr>
<tr>
<td>Risk management</td>
<td>Participant</td>
<td>Provider, who again is absolved of all responsibility, as only an asset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>allocation is agreed to and not a target pension or retirement wealth.</td>
</tr>
<tr>
<td>Currency risk</td>
<td>Participant</td>
<td>Provider, who often will not manage such risks because they got the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>participant to agree to this implicitly.</td>
</tr>
</tbody>
</table>

**Currency risk**: Many funds invest in foreign assets and highlight the impact of currency risks. However, Muralidhar (2001) has shown that the choice of a long-

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189 Ibid.
term benchmark for currency carries with it an implicit bet on the US dollar. For example, an unhedged (fully hedged) benchmark for international assets, which is then passively replicated, takes an implicit view that the US dollar will be weak (strong). Unless active currency management is employed in the international equity fund – a rare occurrence, and even rarer would be the finding that these managers are professional currency managers –, the investor is taking an unmanaged currency bet.

**THE SURVEY SAYS**

There is a famous game show in the United States called “Family Feud,” where two clans compete against each other in answering questions relating to a survey conducted on the general public. Before announcing the results, the host usually leads off with the line, “…and the survey says…” before revealing the answers from the survey, and the clan members realize the accuracy or inaccuracy of their guess. In a similar vein, a recent survey of the general population provided results on their understanding of TDFs: sadly, the survey paints a dismal picture of the participants’ understanding of these products. One would expect that if Table 9.1 were shown to participants, plan sponsors, and DoL representatives, the reaction would be more fear than willingness to participate in these products. The article is taken verbatim from Plan Sponsor magazine’s website to ensure completeness.
“Promises They Can’t Keep: Misconceptions about Target-date Funds

A recent survey from Envestnet Asset Management revealed individuals have trouble understanding target-date funds.

Only 16 percent of survey respondents said they had heard of target-date funds prior to the survey, and 63 percent of those incorrectly described them.

After reading a composite description of target-date funds, respondents said the funds offered the following promises:

- Nearly 62 percent of respondents thought they would be able to retire on the fund's target date;
- 62 percent said they could spend less time tracking their progress toward retirement goals;
- Almost half (48.6 percent) said they could stop worrying about investment and savings decisions and leave everything up to a professional;
- Roughly 38 percent of respondents believe the funds will produce a guaranteed return;
- More than one-third (35.5 percent) of respondents believe their money will grow faster in target-date funds than in other investments; and
- Almost 30 percent believe they can save less money with the funds and still meet their retirement goals.

Respondents also had little sense of the risks of investing in target-date funds:
• 41 percent think there is little or no risk of losing money in a one-year period, and 57 percent believe it is unlikely that they can lose money in any 10-year period;
• One-fifth of respondents believe it is less likely they could lose money in target-date funds than in money market funds, while 50 percent believe the odds were equal;
• 28 percent thought they were less likely to lose money in target-date funds than in equity mutual funds, while 52 percent thought the odds were the same; and
• 38 percent of respondents thought the risk levels in funds with the same target date would be very similar.

When asked to choose from a list of seven potential target-date portfolios, the majority of respondents selected the most aggressive fund, based on expected returns over a 10-year period. Only 8 percent of [the] respondents said [that] selecting a retirement savings rate was the most important retirement planning decision they could make.

Envestnet surveyed 251 individuals aged 25-70 employed now or in the past year.¹⁹⁰

To explain the general implications for the risks borne by DC participants, the attached example highlights the key actions that a year like 2008 would imply to ensure a reasonable retirement. For most young participants, these plans may provide the entire retirement income (given the uncertainties of global Social Security programs).

The case study reviews three identical individuals at different stages of their lifetime – the first, a 25 year-old employee who has just joined the workforce with a $50,000 per year salary. To keep the analysis similar, the case study also highlights the same individual, assuming that she/he had commenced employment in 1988 and is currently 45 years old; the third is an individual on the cusp of retirement, who joined the workforce in 1968 (and is currently 65 years old). The model with its required inputs and outputs as shown in Figure 9.1 is used in the analysis. The assumptions for the general economic environment, demographics, and asset markets are provided in Table 9.2. For simplicity, inflation is assumed to be a static 3 percent every year, and real salary growth is assumed to be 1 percent annually; the participant is expected to live for 20 years post retirement and contribute 10 percent of the current salary (with no caps – again for simplicity) into a pension plan.

The base assumption is that assets earn a guaranteed 8 percent for every year except 2008, when they earn -20 percent. Asad-Syed, Muralidhar and van der Wouden (1998) provide a simple model to help participants establish the linkages

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191 See Modigliani and Muralidhar (2004).
among the variables – for a target replacement, for the given parameters, there is a unique contribution and vice versa (Figure 9.1). In other words, if one sets their mind on a target replacement rate, and experience a bad year of performance, contributions must increase and/or the rate of return on future investments must increase.

**Table 9.2. Assumptions for the case study**

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return in 2008</td>
<td>-20 percent</td>
</tr>
<tr>
<td>Annual Fees</td>
<td>0.75 percent</td>
</tr>
<tr>
<td>Starting Income</td>
<td>50,000</td>
</tr>
<tr>
<td>Standard Contribution</td>
<td>10 percent</td>
</tr>
<tr>
<td>Return on Assets Prior to and After 2008</td>
<td>8 percent</td>
</tr>
<tr>
<td>Annual Salary Growth</td>
<td>4 percent</td>
</tr>
<tr>
<td>Annual Inflation</td>
<td>3 percent</td>
</tr>
<tr>
<td>Working Life</td>
<td>40 years</td>
</tr>
<tr>
<td>Post Retirement Life</td>
<td>20 years</td>
</tr>
</tbody>
</table>

Aon (2008) demonstrates that a reasonable replacement rate for an average cohort is approximately 70-78 percent of the final salary. As post-retirement costs, including taxes, are lower, individuals need to target a much lower income post retirement. Table 9.3 provides the results and shows what would happen in a perfect world. If the various parameters are fixed, then in a perfect world with no stochasticity of variables, the participant would receive approximately 72 percent of the final salary (or 142 percent of the average salary). Conversely, should the participant choose to receive a 100 percent replacement rate in every year of retirement, then at an 8 percent annualized return, they must contribute approximately 7 percent for a pension that is based on the average salary and 13.9 percent for a pension that is based on the final salary.
Table 9.3: A Perfect World – The link among replacement rates, contribution rates and rates of return

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Replacement Rate</th>
<th>Balance at Retirement</th>
<th>Contribution at 8% for 100% Replacement</th>
<th>Contribution at 7.25% for 100% Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect Life - Average</td>
<td>141.85%</td>
<td>2,284,673</td>
<td>7.05%</td>
<td>8.87%</td>
</tr>
<tr>
<td>Perfect Life - Final</td>
<td>71.94%</td>
<td>2,284,673</td>
<td>13.90%</td>
<td>17.50%</td>
</tr>
</tbody>
</table>

The last column in Table 9.3 demonstrates one of the more insidious aspects of the current TDFs – namely, the impact of fees. By all accounts, the fee of the average product is approximately 0.75 percent annualized. This is high for the services provided and fees can and should be dramatically reduced; but the key point is that the application of fees reduces the net return which, in turn, raises the required contribution by 1.82 percent a year (if the client seeks a 100 percent replacement on the average salary) and by 3.6 percent a year for a participant focused on the final salary. This simple table demonstrates the dramatic impact of fees – however small – on saving behavior, but the advice is not being provided to participants.\(^{192}\) This is particularly relevant because in 2008 many companies dropped or dramatically lowered their 401(K) match in the United States – simply put, they implicitly told participants to lower their retirement expectations, especially given the damaging impact of asset performance in 2008.

To highlight the impact of a year like 2008 on retirement planning, Table 9.4 demonstrates how it affects participants in various cohorts – from a new entrant,

\(^{192}\) I thank Roger Paschke of the Hearst Corporation for motivating this discussion. In his quest to design the best system for his participants, he continues to focus on advising staff on how to save, and the next table is in response to my discussions with him.
to a mid-career employee, and a person on the cusp of retirement. For simplicity, assume that all TDFs earned -20 percent in 2008. As many fund providers have not changed their long-term expected return forecasts, continue to assume that the glide path ensures an 8 percent (or 7.25 percent after fees) annualized return. This means that fixed income returns must increase over time (as these portfolios tilt more into fixed income), a situation that is probably at odds with the current level of rates and the potential impact of inflation. For the new entrant, a big shock like the 2008 bleak performance requires higher contributions, i.e., contributions that are only slightly higher than the original target contribution – but if a company match has been withdrawn, then the participant needs to step up to the plate to make up the difference (and this will hinder consumption at a macro level which does not augur well for the future return on equity).

The problems really begin to show in the case of the 45-year old employee, as the negative return was earned on a pool of assets that was reasonably substantial (i.e., the -20 percent returns was not applied just to the contribution for 2008, but to the entire savings until that date). In simpler terms, given the reduced time to make up shortfalls as one ages, the 2008 performance requires that a 45 year-old participant double their contribution to remain hopeful of achieving the original target replacement rate. With the 65 year-old, the number is not reported. The required contribution is in excess of 400 percent, as the depletion of wealth is devastating!
Table 9.4: Impact of 2008 and fees on different cohorts with different retirement objectives

<table>
<thead>
<tr>
<th>Age in 2007</th>
<th>Wealth at end 2007</th>
<th>Wealth at end 2008</th>
<th>Contribution at 8%</th>
<th>Contribution at 7.25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 Year Old - 100% Average</td>
<td>5,400</td>
<td>4,320</td>
<td>7.10%</td>
<td>9.03%</td>
</tr>
<tr>
<td>25 Year Old - 100% Final</td>
<td></td>
<td></td>
<td>14.18%</td>
<td>17.90%</td>
</tr>
<tr>
<td>45 Year Old - 100% Average</td>
<td>344,383</td>
<td>275,507</td>
<td>15.01%</td>
<td>16.92%</td>
</tr>
<tr>
<td>45 Year Old - 100% Final</td>
<td></td>
<td></td>
<td>28.72%</td>
<td>31.42%</td>
</tr>
<tr>
<td>64 Year Old - 100% Average</td>
<td>2,115,438</td>
<td>1,692,350</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>64 Year Old - 100% Final</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

So, to the T. Rowe Price manager who said that 2008 was just one year out of many, we say: Tell it to the 65 year-old, and even to the 45 year-old who now has to save double. However, a smart plan sponsor’s expectations from this same manager should be on the lines of: “maybe the bulk of the fees need to be deferred and paid only if the target return is achieved.”

SIMPLE FIXES AND SUGGESTIONS FOR IMPROVEMENTS

“Honest businessmen should be protected from the unscrupulous consumer”
Lester Maddox$^{193}$

The industry’s current approach to the problems of the 2008 downturn border on the inefficient. Rather than fixing what is broken, the entire focus is on (i) whether to include outside managers or not, or add passive managers to lower fees; (ii)

$^{193}$ Petras and Petras (2001), page 31, quoting Lester Maddox, then governor of Georgia, on why Georgia should not create a consumer protection agency.
add illiquid, high fee asset classes such as private equity and hedge funds; (iii) find a way to incorporate the managers in the DB plan to lower manager costs; (iv) meddle with the glide path; and (v) add new asset classes (TIPs, Emerging markets) to “increase diversification.” There is apparently some attempt to start to guarantee annuities as the focus shifts from asset allocation to retirement income, but this is far from the norm.\textsuperscript{194} Since, unfortunately, none of these measures achieves any lasting benefit, a few alternatives are suggested below. In addition, this chapter makes a minor contribution to the serious attempt to benchmark and rate these funds, and attribute performance to various decisions.

**PROVIDERS MUST STATE A TARGET RETURN (OR REPLACEMENT RATE)**

At a minimum, plan sponsors should require TDF providers to state a long-term return on their various products. While there is no guarantee that these will be achieved, at the least the participant will know where they stand and can engage in thoughtful retirement planning, using the model in Figure 9.1 and a version of the analysis provided to support Table 9.2. In this manner, TDF products may be ranked more clearly based on their target return, using either absolute or risk-adjusted rankings. However, plan sponsors tend to be concerned that participants who are not financially sophisticated may not be capable of making the distinction between higher returns and higher risk.\textsuperscript{195}

\textsuperscript{194} \url{http://www.pionline.com/apps/pbcs.dll/article?AID=/20090421/REG/904219997&nocache=1.}

\textsuperscript{195} I thank Roger Paschke for this clarification.
PROVIDERS MUST BE EXPLICIT ABOUT WHAT RISKS PARTICIPANTS BEAR AND GUIDE THEM ON SUCH RISK TAKING

If providers continue to provide TDF products, the least they can do is improve their disclosures of risks being borne by participants and the ways to mitigate the risk. For example, all these TDF providers are massive investment complexes – with complete teams of well-trained staff who can provide advice (for free) on how the funds are likely to perform in the coming year, given their outlook on stocks versus bonds. With such information, a smart participant can at the least switch from the fund they are in to another that reflects the best thinking of the fund complex. In effect, getting out of a fund that is likely to underperform is risk management. Stepping out of a few land mines will allow a high probability that retirement objectives are achieved without substantial additional sacrifices.

CREATE EXPOSURE TO ASSETS THROUGH FUTURES AND DRAMATICALLY LOWER COSTS

If the key to achieving long-term retirement objectives, at least with the blind rubber stamp of the Department of Labor’s QDIA, is to focus on asset allocation, then maybe the various fund providers should give participants a break and use futures to create a broadly diversified portfolio of assets that are liquid, transparent, readily traded at low cost, have limited credit risk, etc. Today, for the average US client, the following exposures can be readily created: US Large Cap, US Small Cap, MSCI EAFE, MSCI Emerging (low liquidity today, but if $10 billion moved to this market, liquidity would improve dramatically), US Government
Bonds, Foreign Government Bonds, Currency, and even Commodities. One would expect that utilizing futures to create asset class exposure can save participants as much as 0.5 percent annually relative to industry average costs. Therefore, this can also be considered to be the benchmark to measure all TDFs, as discussed later, as this is the most liquid, transparent, lowest cost portfolio.

APPLY SMART REBALANCING TO THE VARIOUS FUNDS

Since the fund managers are taking a host of bets almost as a matter of practice, it seems like the most valuable bet would be to implement a SMART Rebalancing program. In this fashion, the link to an artificially chosen and DoL rubber-stamped dynamic asset allocation can be easily mitigated. So if it turns out that older cohorts are largely being pushed into fixed income, but given current yields and the likelihood of further debt being issued by the government to bail out an economy in trouble or any rise in inflation, the general consensus is that fixed income will perform worse than, say, cash or equities, then fund managers (and even the DoL) should implement some version of SMART Rebalancing to protect the naïve participant.

ENSURE CLEAR ATTRIBUTION OF PERFORMANCE

As shown in Chapter 1, the same principles of attribution can be applied to TDFs as they are operating in much the same way as pension funds, and have only three sources of excess return over the futures-based benchmark; namely, (i) manager value added (by mandate); (ii) choosing benchmarks different from the
futures-based benchmarks; and (iii) dynamic allocation to various decisions versus a static allocation. Figure 9.2 is a repeat of the same chart shown in Chapter 1.

**CUT FEES AND DEFER THEM TILL SUFFICIENT TIME HAS PASSED**

Once fund managers use futures contracts to create asset class exposure and drop the basic fee, then plan sponsors should go the additional step of righting another wrong – namely, **not paying managers up front for performance that is not guaranteed for many years into the future**. Fund managers should get a basic fee of a few basis points to set up the structure of the funds, but the balance of the fee should be paid out only when they can credibly show that they have outperformed the static, naïve benchmark on a risk- and skill-adjusted basis. Setting up the right incentive scheme is critical to ensuring that fund managers do not go on a massive asset-gathering run, but rather focus on delivering the objectives that the participants need. This will be covered in more detail in future research, as a number of operational issues need to be clarified.

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196 We will pursue this in separate research, but in a nut-shell, this would require calibrating all target date funds to a fund that is run (a) with a static allocation which at the current average expected return of all vendors achieves say an 8 percent expected return; and (b) assumes that all assets are created using futures – so the benchmark indices are also chosen. The glide path is a tactical bet as is the choice of managers other than the most liquid option. Now every fund can be measured against this live fund on an after-fee basis and risk adjustment could be done using either the M-square or the M-cube (will require a target risk budget). The manager will also only be paid the balance of the fee once the confidence in skill exceeds some threshold such as 75 percent. All of this has been covered in the book in Chapters 2, 3 and 7.

197 I thank Karin Brodbeck for this comment.
This is a topic for a complete book on its own, given the diversity in starting allocations, glide paths, choice of benchmarks, etc. Gardner and Sirohi (2007) present a simple but very effective measure of performance which they term the Target Date Performance Measure (TDPM). They propose a measure as follows:

\[
TDPM = \frac{W_F}{W_B} \times 100 \tag{9.1}
\]

where \(W_F\) is the wealth generated at the target date by holding a target date fund from inception to target date; \(W_B\) is the wealth generated at the target date by holding the benchmark fund from inception to target date; and 100 is used for normalization. The attractive feature of the TDPM is that all funds can be measured on wealth rather than returns; and all funds in a family can be
compared. The problem is that as there is no risk- and skill-adjustment, one needs to develop norms along the lines of adjusting for the fact that the fund manager can increase the fund’s volatility, or the fact that one fund having a higher TDPM than another in the short term may be more a matter of luck than of skill.

**SUMMARY**

Target funds have ballooned to approximately $185 billion, yet the fact that performance tumbled dramatically in 2008 has proved unquestionably disastrous. A cursory examination of these funds is sufficient to realize that they have been poorly designed, ineffectively marketed, and not explained to the participants. The marketing material is designed to prevent lawsuits, but does not let the average participant in a 401(K) plan realize what investments decisions they are making, as opposed to delegating to the fund providers, and that too for high fees. The chapter debunked the appeal of these products by highlighting the poor design, suggested benchmarks for these funds that allow for risk-adjusted performance (across all target dates and fund families), and discussed more appropriate fee structures, given the length of mandate and the high likelihood that these products will not fulfill investors’ expectations. This analysis will probably lead to a totally new regulation of these funds and hopefully have them removed from a list of Qualified Default Investment options allowed by the DoL unless the United States wants to bail out yet another industry for poorly designed regulation.
Conclusion

“And what is more, I agree with everything I have just said.” Piet Koornhoff¹⁹⁸

The year 2008 was a watershed for the investment management industry, as volatile markets exposed the flaws in the theory and the practice of pension fund management. Solvency declined dramatically, globally, as the asset-liability mismatch was exposed (as was the irrelevance of bad LDI); hedge funds did not deliver on the promise of generating alpha (for very high fees); rebalancing policies detracted value because they anchored themselves to a declining portfolio; liquidity dried up; and equity became the only asset to sell, causing further problems. However, warning signs were everywhere, and many analysts had shouted “Wolf!” only to be ignored.

The primary source of the problem is financial theory and its standard bearer – the CAPM. Academics who have never managed pension funds ignored the most dominant class of institutional investors – those who delegated decisions to others – and the impact of the behavior of pension funds on markets. First, these investors worry about relative risk and relative performance, which impacts the choice of investment strategy and the manager hired. Second, the whole focus on optimal portfolios (à la Markowitz) assumes certain asset correlations,

masking the bet that investors make on markets, and the economic factors that drive these bets. Finally, the CAPM-type results focused on static solutions to portfolio problems, ignoring the time dimension (the inter-temporal CAPM of Merton notwithstanding) in making decisions.

As a result, CIOs had to deal with four major shortcomings; (i) the fixation of the investment management industry on static prescriptions to manage assets in dynamic markets, especially for long-term strategic asset allocations (SAAs) and naïve rebalancing; (ii) asset managers who offered naïve “magic bullet” solutions to sell products rather than solve pension fund problems – most evident in LDI and multi-manager programs (which, again, are static solutions); (iii) performance measures/fees that did not adjust for risks or skill and, hence, served the asset manager more than the pension plan – most evident in hedge funds, but quickly followed by mainstream asset managers; and (iv) benchmarks recommended to pension funds are difficult to replicate in the futures market, making it hard for CIOs to be nimble in managing a fund (without taking “fake” tracking error), especially as markets zigged and zagged. The value attached to dynamic decision-making was miniscule, with many analysts deriding “market timing”, without realizing that every bet in a portfolio, starting with the SAA, is market timing!

We are sure to repeat our mistakes if we do not learn from them, and while there has been considerable introspection on expected return and volatility assumptions, relatively little attention has been paid to the correlation statistic. Ignoring the fact that correlations across two assets or managers may be dynamic, investors must focus on a much simpler problem, namely, understanding the implied bet in choosing a correlation value in setting an SAA or manager structure. A low correlation between stocks and bonds is caused by the fact that
they respond differently to economic growth, interest rates, oil, etc. The same is true for every other correlation statistic between two assets or two managers. Therefore, in setting an SAA or in selecting a portfolio of managers and assuming specific correlations (and expected returns), pension funds are making a bet on these economic relationships, and one must exploit them in the implementation and management of a portfolio.

Static policies for dynamic markets are undoubtedly flawed and have to be changed with the support of appropriate liquid, transparent, and low-cost, futures-based benchmarks; implicit bets (especially in the static SAA, rebalancing and liability and currency hedges) need to be made explicit and managed dynamically; naïve performance measures have to be improved to properly adjust for risk and highlight skill or lack thereof; and the CAPM needs to be revamped dramatically. Investors must understand how various market factors influence assets or managers and then develop a set of rules so that as the factors evolve over time, the optimal portfolio evolves simultaneously. For example, as the price of oil rises, the optimal portfolio may be 59 percent stocks, 41 percent bonds (versus a 60/40 SAA) and the optimal liability hedge may be less than 100 percent. This is termed “view-based” rebalancing. Similarly, as solvency declines, a “view-neutral” dynamic LDI would reallocate the optimal SAA to be overweight in a liability replicating fixed income allocation.

As Woody Brock states, the future is about optimal strategies rather than optimal portfolios. Effective CIOs will establish optimal portfolios for specific states of the world and then dynamically adjust their portfolios as the market moves from one state to the next. Developing rules to track market movements, and their impact on all liability, beta and manager decisions, creates a systematic process that
generates consistent recommendations, not easily influenced by emotion (though clearly leaving scope for applying informed judgment in the implementation of these recommendations).

SMART (Systematic Management of Assets using a Rules-based Technique) management of assets and liabilities leads to improved solvency and a lowering of ALM risks. SMART is about good process – namely, only measured and monitored risks can be managed (“M-cube of investing”). Rules that make explicit the underlying factor relationships alerts overburdened and under-resourced CIOs to make key decisions to appropriately position the portfolio for better solvency (and not just a return over an investment benchmark). Good risk-adjusted performance measures ensure that the managers they hire generate, and are compensated for, risk- and skill-adjusted performance. Therefore, this book is also a call to arms to change manager compensation so that the bulk of the fees can be deferred until skill is established.

To summarize, pension funds should incorporate three levels of dynamism in managing the assets and liability to improve solvency: (i) Dynamic LDI; (ii) View Neutral Solvency-Based Beta Adjustment; and (iii) View-Based (or market-factor based) SMART Beta and Alpha Management. Explicit factor analysis and exposition of these rules lend themselves to transparency and good governance, whereas optimized portfolios are derived from black boxes where the investor is not sure whether the decision is driven by the return, correlation, or volatility assumption. This book presents a new design for pension fund management that allows CIOs to be smart about managing assets relative to liabilities and, at the same time, allows them to access alpha flexibly, manage managers dynamically for true alpha, and improve solvency.
It is our hope that we do not follow Mark Twain’s advice when he stated, “Never put off until tomorrow what you can do the day after tomorrow.”

\(^{2}\) http://www.quotationspage.com/quote/416.html
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Glossary

AAPF: ABN AMRO Pension Fund.

Alpha: In this book relates to returns in excess of the benchmark (not adjusted for risk or beta).

ALM: Asset-liability management is the practice of managing risk that arise due to mismatches between the assets and liabilities.

AUM: Assets under management.

Bp: Basis point. A unit that is equal to 1/100th of one percent, and used to denote the change in a financial instrument. The basis point is commonly used for calculating changes in equity indexes and the yield of a fixed-income security.

Beta: describes how the expected return of a stock or portfolio is correlated to the return of the financial market as a whole. An asset with a beta of 0 means that its price is not at all correlated with the market; that asset is independent. A positive beta means that the asset generally follows the market. A negative beta shows that the asset inversely follows the market; the asset generally decreases in value if the market goes up and vice versa (as is common with precious metals). In addition, in this book beta refers to decisions relative to the benchmark.

CalPERS: California Public Employees’ Retirement System

CAPM: Capital asset pricing model. A model that describes the relationship between risk and expected return and that is used in the pricing of risky securities.

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200 This section has leveraged Wikipedia and Investopedia extensively.
**CAPs**: Risk adjusted portfolio, adjusted for differences in correlation, created through the M-cube adjustment.

**CIO**: Chief investment officer

**CRAPM**: Capital relative asset pricing model. A model that describes the relationship between risk and expected return and that is used in the pricing of risky securities based on a relative analysis of markets.

**DB**: Defined benefit. An employer-sponsored retirement plan where employee benefits are based on a formula using factors such as salary history and duration of employment

**DC**: Defined contribution. A defined contribution in which a certain amount or percentage of money is set aside each year by a company for the benefit of the employee. There are restrictions as to when and how you can withdraw these funds without penalties.

**DnB**: Dutch Central Bank

**DoL**: U.S. Department of Labor

**ETF**: Exchange traded fund

**FAJ**: Financial Analysts Journal

**FoF**: Fund-of-funds. A fund-of-funds is a collective investment scheme that uses an investment strategy of holding a portfolio of other investment funds rather than investing directly in securities.

**Funded Status**: Ratio of assets to liabilities

**GP**: General partner

**IDP**: Investment Decision Process is a method of expressing the hierarchical structure of decisions in a portfolio. This concept was developed by the Shell Netherlands pension plan.

**IR**: Information ratio is a measure of risk-adjusted performance
**IRA**: An Individual Retirement Arrangement is a retirement plan account that provides some tax advantage for retirement savings in the United States.

**IRS**: United States Internal Revenue Service

**KISS**: Keep it SMART and simple

**LDI**: Liability-driven investing. A form of portfolio management in which the main goal is to gain sufficient assets to meet all liabilities, both current and future. This form of investing is most prominent with defined-benefit pension plans, whose liabilities can often reach into the billions of dollars for the largest of plans.

**LP**: Limited partner

**Maximum drawdown**: Defined as the largest drop from a peak to a bottom in a certain time period.

**M² or M-square**: Risk-adjusted performance measure developed by Franco and Leah Modigliani that normalizes for differences in volatility

**M³ or M-cube**: Risk-adjusted performance measure developed by Arun Muralidhar that normalizes for differences in volatility and tracking error

**PBGC**: Pension Benefit Guarantee Corporation – entity in the United States that provides insurance against sponsors of DB plans going bankrupt.

**PME**: Bedrijfstakpensioenfonds Metalectro in the Netherlands

**PPA**: United States Pension Protection Act (2006) that governs DB and DC pension plans and contains many new provisions to enhance the security of participants’ pensions.

**QDIA**: Qualified Default Investment Alternative. The Pension Protection Act of 2006 provides a safe harbor for plan fiduciaries investing participant assets in certain types of default investment alternatives in the absence of participant investment direction.

**RAP**: Risk adjusted portfolio created through the M-square adjustment.
**RFP**: A Request for proposal is an invitation for suppliers, often through a bidding process, to submit a proposal on a specific service.

**SAA**: Strategic asset allocations. At the inception of the portfolio, a "base policy mix" is established based on expected returns. Because the value of the portfolio can change given market conditions, the portfolio constantly needs to be re-adjusted to meet the policy.

**SHARAD**: Skill, history and risk-adjusted performance developed by Arun Muralidhar that normalizes for volatility, tracking error and length of performance history.

**SMART**: Systematic management of assets using a rules-based technique

**SMART VB**: SMART view-based

**SMART VN**: SMART view neutral

**SS**: Social Security

**Success ratio**: Percentage of days/months that the performance was greater than the benchmark

**SWF**: Sovereign Wealth Fund

**TDF**: Target date fund. Target-date funds invest in a mix of stocks and fixed-income securities, and the percentage of these assets classes switches to more conservative investments as a fund approaches its target date. The switch in allocation is known as a "glide path."

**TDPM**: Gardner and Sirohi (2007) present a simple but very effective measure of performance which they term the Target Date Performance Measure or TDPM.
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